AMERICAN MACHINIST

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Double Four-drum Hauling Engine.

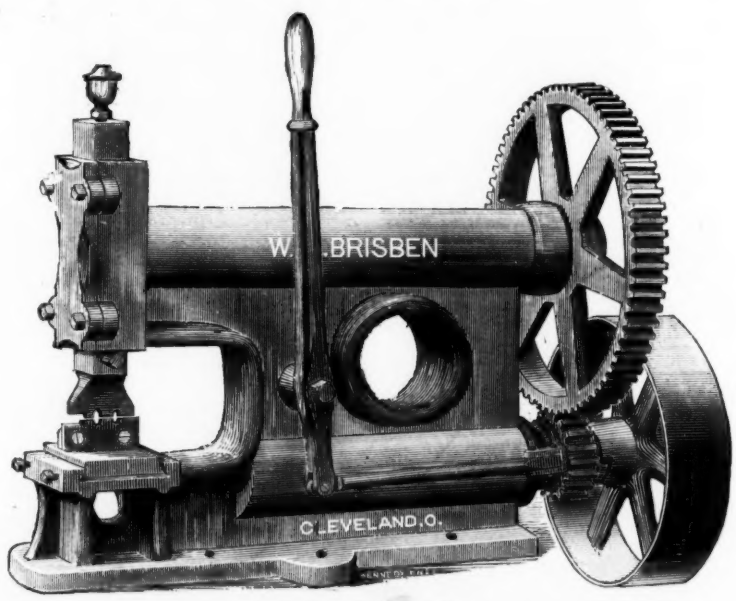
The engravings on this page, and on page 3 represent a four-drum hauling engine for mines, made by the Ottumwa Iron Works, Ottumwa, Iowa. What is known as the "tail rope" system of underground haulage is coming into very general use in mines, extensively superseding animal power, and the engine we illustrate is a heavy and strongly built one for this purpose. This is essential, as this class of machinery is subject to severe usage, and does not generally receive much attention.

These engines are arranged with positive clutches, or friction, if preferred. Each drum is controlled independently by its own brake, clutch, pinion and gear, admitting of the immediate control of either or all of the drums, separately or together, as circumstances require; the operation of two different workings from a point contiguous to the main shaft is effected through the use of two sets of drums working in pairs.

The engine beds are formed by bolting together accurately fitting castings, providing when together, and to the foundations a solid support for the drums and working parts. The cylinders are fitted with steam packing; the guides combine the features of the circular and locomotive type, and are arranged to economize space and to provide accurate adjustment of the crosshead.

The drums, of cast iron, are spirally grooved for wire rope. They are supported each upon its own shaft, provided with adjustable boxes.

The clutch-shafts and brake-rods, with their operating levers, are arranged conveniently for the operator. Each engine is provided with an automatic indicator, which enables the operator to locate the train at any point in its trip.



POWER PUNCH AND SHEAR.

Self-contained Engines.

BY W. H. HOFFMAN.

Since the advent of high-speed engines in various forms for stationary purposes, I have often wondered that so few of them should be made self-contained. All high speed engines, or even those running from 90 to 250 revolutions and in powers from 30 to 150 horses can be made with outside bearing for main shaft cast or bolted to the main frame or bed-plate of engine, thus making it self-contained.

Several builders making special engines for electric lighting, are now constructing these machines with both main and outer bearings attached to frame, either using a double or single crank, with driving pulleys one side or both sides of engine bed. I think the single-crank style the best, as it is simple in construction, and gives us the ordinary plain crank-pin drawn into the crank or disk on a taper, allowing for easy repair, such as re-turning and grinding when necessary. It is an excellent idea to make all small engines self-contained, as they can be fastened to heavy floors or beams without erecting a regular foundation; but it is just as necessary that all stationary engines should be built on this plan, as the larger ones requiring foundations are much more liable to get out of line, causing friction heating, and other damage.

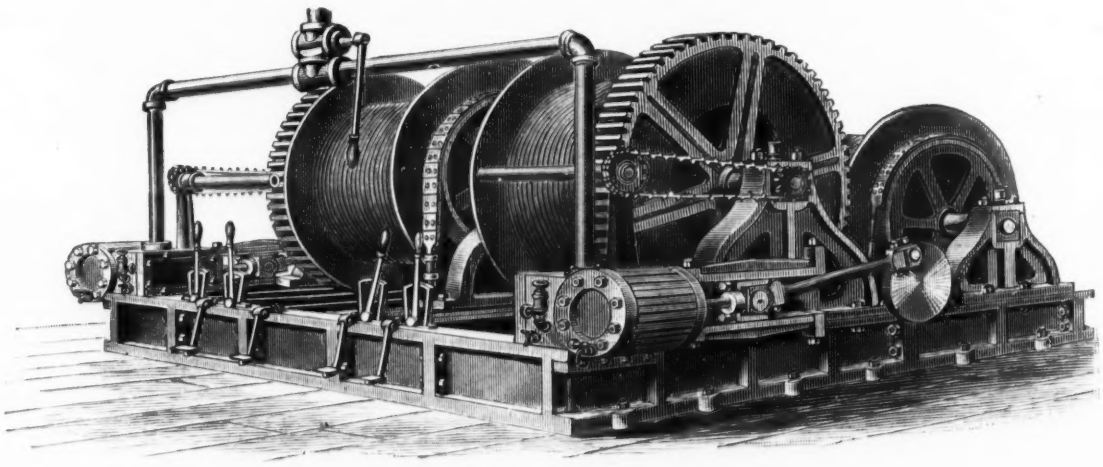
I believe there is nothing in the way of constructing an engine with a cylinder 14" diameter, and with a stroke of 24", to run at 150 revolutions and to develop 100 horse-power on the self-contained plan. The arm for holding the outer bearing, can be *cast* to the engine bed on this size, leaving a space for the governor, eccentrics and driving pulley only, and placing the fly-wheel *outside* of the outer bearing, when necessary to have one. In most cases, however, the fly-wheel and pulley can be cast in one. The driving pulley for 100 horse-power and 150 revolutions need not be more than six feet in diameter, and 24' face, therefore the supporting arm or extension need be but little below the bottom line of main bed-plate and can be built into the foundation.

Engines above 100 horse-power can have this arm and outer bearing cast separately from the main bed, planed and bolted to it, thus making it convenient for handling in the shop, and in transit. The advantages of this system of construction are many. In the first place, the builder can arrange each engine in the erecting shop to move under steam there, and thus know that all the main journals are properly seated. The engine can be put absolutely in line, under the eye of the master mechanic, and it will then go on to its foundations in perfect line, and will remain so; for thould the foundations settle, the engine in this form can be readily leveled to its proper position.

The arm or extension on large engines can be of the I beam section, giving stiffness without undue weight, and can have a firm connection to the main bed in all cases. Of course engines of large powers, and slow speeds, having necessarily large driving and fly-wheels, cannot be conveniently designed in the self-contained form. I believe though that a large amount of friction could be dispensed with if this plan could be adopted for the class of engines just mentioned.

The self-contained engine costs less than any other to erect, and requires less time to take the whole working load without danger of cutting, and it will make long continuous runs, with very little attention to the main bearings, that are generally liable to be troublesome under heavy and continuous work.

The cost to build on this plan, may be a *little* more than that of an engine with an independent outer bearing resting on a stone pier, but when the self-contained engine leaves the builder's hands, the most of his troubles are over. There is very little annoyance from the *standard* valve motions now in use, if they are properly fitted in the shop, and my experience has led me to believe that the other end of the machine requires the most attention in moderate as well as excessive high speeds. I claim that the main shaft journals should be ground while revolving on centers, the crank having previously been shrunk or pressed on; then, while the shaft is hanging on its centers in the lathe, the crank-pin hole should be bored by a special fixture attached either to the head or tail stock of the lathe. This hole will then be absolutely true with the crank and shaft, as a finishing cut is taken on the crank or disk, just before boring the crank-pin hole. Now, when the crank-pin, after being ground on *its* centers, is placed in this hole, I call this job complete in itself, and when the shaft is placed in a self-contained engine frame, then the "business end" of the engine is also complete in itself."



DOUBLE FOUR-DRUM HAULING ENGINE.

Brisben's Power Punch and Shear.

This tool is intended for use in die and press work, stamping, etc., and is particularly constructed for convenience in doing this class of work. The shafts, of steel, run in bearings the full length of the machine. The gear wheels are cut from the solid. The large wheel is 12 inches, and the pinion 4 inches diameter; stroke of run, one inch. It will shear plate up to three-sixteenths inch diameter. The manufacturer is W. W. Brisben, Cleveland, Ohio.

Snow Blockades on Railroads—Locomotive Inspection.

Snow blockades on Northwestern railroads have caused a great deal of annoyance and damage this winter. Harrowing tales have been published of trains snowed up in out-of-the-way places, while the shivering and hungry passengers patiently waited for deliverance by breaking through the drifts, or were huddled into sleighs and driven to some point of transfer. These blockades have troubled the longer and presumably better-equipped lines as frequently as the shorter and less important ones, but not a single snow blockade has occurred on the Northern Pacific, although its line traverses a region where such a difficulty would not be considered at all remarkable. Blizzards there have been sweeping across its track, but they were fully anticipated. Although every precaution was used in the construction of the road to guard against snow, the task of keeping the tracks open in such winters as are experienced in the Northwest devolves upon the mechanical department, and it has been fully met by Mr. G. W. Cushing, the superintendent of motive power. Thirty-nine locomotives are fitted with snow plows, such as shown in the AMERICAN MACHINIST of January 19,

1884, and further referred to by Mr. Cushing February 9, 1884, and twenty track-flanging machines are in service whenever required. These are the appliances which, managed by men of intelligence and experience, keep the track clear when other roads in the same region get blockaded by snow.

The system of locomotive inspection and reports instituted by Mr. Cushing on the Northern Pacific is admirable, and is worth the special attention of the mechanical department of other roads. Regular detailed reports are made to the superintendent of motive power from each of eight divisions. They include, first, a semi-monthly report of the location of engines; second, a monthly report of work done by each engine; third, a quarterly report of the condition of driving-wheel brakes; fourth, a quarterly report on the condition of boilers; fifth, a quarterly report on the condition of air brakes; and sixth, a quarterly report on the condition of injectors.

Blanks are furnished which must be filled out and signed by the inspector and master mechanic of the division.

Mr. Cushing says: "You would hardly believe the benefit of these reports or the trouble in getting the system started." After getting used to it, however, the men charged with the work are so well pleased with the results that they would not like to abandon it.

Herewith we present copies of three of the blanks used for reports. The report on driving-wheel tires, notes the amount worn off and the length of flat places, if there are any. When they are worn down to the limit of safety (before they are thin enough to be in danger of giving way), they are cast aside. In some of the reports we looked over the wear of $\frac{1}{64}$ of an inch was noted.

Of course, the main object of these inspections is to discover and remedy defects before they become bad enough to cause a breaking down on the road. Accidents are thereby avoided. There are practically *no failures* of boilers on the Northern Pacific.

The inside of injectors, with some water used on this line, rapidly fill with a crusting of lime. In order to clean them readily, the plan has been adopted of cutting them into three sections and joining them together, so as to be conveniently taken apart.

As will be understood, these reports require special examination in detail at stated intervals. The usual daily inspection of locomotives is not taken as the basis of these reports. All these special reports are filed away in the office of the superintendent of motive power, so as to be referred to at any moment.

NORTHERN PACIFIC RAILROAD.
MACHINERY DEPARTMENT.
Quarterly Inspection of Injectors.

.....188...

Engine.....has this day had special examination of injectors and attachments, and all parts are found to be in condition as stated below.

	Condition.	Remarks.
1. Main steam valve		
2. Boiler checks, pipes and attachments		
3. Water regulator cocks, hose, etc		
BODY OF INJECTOR.		
4. Jet valve		
5. Steam valve		
6. Lazy cock		
7. Heater cock		
INTERIOR TUBES.		
8. Steam		
9. Intermediate or combining		
10. Condensing, or receiving and delivery		
11. Receiving		

Approved:

....
Master Mechanic. Inspector.

NOTE.—Injectors should have daily inspection with other parts of engine, and at close of month examination in detail for purpose of this report, which will be sent to Sup't M. P. M. & R. S. Every part, as above, must be examined and condition carefully noted.

G. W. CUSHING,
Sup't M. P. M. & R. S.

Quarterly Boiler Inspection.

.....188...

I have this day inspected boiler of engine ..... and found it in the following condition:

Shell.....
Flues.....
Staybolts.....
Fire-box plates.....
Crown sheet.....
Crown bar bolts.....
Grates.....
Ash-pan.....
Smoke-stack.....
" " netting.....
Mud drum and fixtures.....
Safety valve.....

REMARKS.

.....
.....
.....
.....
.....

Tested at steam pressure of .....lbs.....
" " water " " ..... " .....

Correct:

....
Master Mechanic. Inspector.

Quarterly Inspection of Air-brakes, etc.

.....188...

Engine.....has this date been specially examined by me, and the air-brake apparatus is found in the condition below stated:

	Condition.	Remarks.
1. Steam throttle and pipes		
2. " lubricator		
3. " piston packing, heads and glands		
4. Main steam valves, bushings—upper and lower		
5. Reverse valve, stem, plate and bolt		
6. " piston, packing, rings, bushes and cap		
7. Exhaust pipes and fixtures		
8. Pump, governor (regulator) parts and attachments		
9. Air cylinder, body valves, piston, packing, glands, heads and lubricator		
10. Air inlet pipes and strainer		
11. Main reservoir, pipes, hose and attachments		
12. Tender, air cylinder, piston, rod and attachments		
13. Triple valve and attachments		
14. Pressure retaining valve and attachments, pipes, cocks and hose		
DRIVER BRAKES.		
1. Cylinder, piston, packing, glands, crosshead and attachments		
"LA CHATALIER" WATER-BRAKE.		
1. Throttle, pipes and attachments		
TRAIN SIGNAL APPARATUS.		
1. Reservoir, pipes, cocks, hose, coupling and holder		
2. Signal valve and attachments		
3. Reducing valve and attachments		
4. Whistle, pipes and cocks		

Approved:

....
Master Mechanic. Inspector.

NOTE.—This is a special report to be made at close of each quarter and sent to the Sup't M. P. M. & R. S. When parts are found showing signs of failure, a special report must be made to the master mechanic.

Face-plate Chucking Bolts.

Old-fashioned chucking bolts are seldom met with in shops of the present day, yet for bolting odd jobs to a lathe face-plate these bolts are not to be despised. A bolt is turned out of a $1\frac{1}{2}$" bar of iron, the head being left as long as its width, and the turned part made to fit the holes or slots in the face-plate. A $\frac{1}{2}$" or $\frac{5}{8}$" steel set-screw is fitted into a hole drilled through the center of the bolt-head perpendicular to the axis of the bolt. Any object, either round, square, or irregular, to a size up to 4" less than that of the face-plate, may be easily chucked by use of three or four of these bolts.

The bolts may be put through the face-plate holes, adjusted so the screw will bear in any required direction, and held firmly in place by tightening up the nuts at the back of the face-plate. The bolts may also be used in the interior of a hollow shape, thus chucking as large or larger than the face-plate. Two or three hook bolts will be needed with these chucking bolts.

The Salem, Mass., city council committee on public property, says the Lynn *Reporter*, having reason to believe that the hand grenades distributed in the public buildings were deteriorating, thought it would experiment with some in a school-house basement one day last week. So the committee built up a little fire, and then began to break hand-grenades on it. After throwing 25, the fire still burned briskly, but a handful of snow extinguished it.

The Effects of Blue Heat on Steel and Iron.

FROM A PAPER READ BEFORE THE INSTITUTION OF CIVIL ENGINEERS BY MR. C. E. STROMEYER ASSO. M. INST. C. E.

It was stated that, in spite of the many excellent qualities possessed by mild steel, and in spite of its extended use for shipbuilding and for marine boilers, many engineers considered it a treacherous material. They were able to adduce numerous instances in which steel plates and bars had failed, in their opinion, in an unaccountable manner. In nearly all such cases a cursory examination brought the fact that the plates in question had been subjected to bending or hammering while hot, and there could be little doubt that while they were being worked these plates were at a blue heat, or, as smiths and boiler-makers term it, a black heat. It should by this time be well known that such treatment was the most injurious to which steel could possibly be subjected, and therefore such failures could not be properly regarded as unaccountable. Iron possessed the same peculiarity, but, being less ductile than steel, similar failures were not so glaring.

The author then mentioned cases in which plates, both of iron and of steel, had failed without this treatment, although the quality of the material was good, according to the usual tests. Three hundred and thirty experiments had been made in connection with the subject of the paper, and consisted mainly of bending and of tension tests. The results were contained in tables and in diagrams.

It appeared that the limit of elasticity of both iron and steel was raised by repeated tension testing. In some cases the limit rose above the original breaking stress, although the ultimate breaking stress was only slightly affected. The total elongation was reduced by previous mechanical operations, while the contraction varied considerably. A test piece which had been shortened when cold showed a reduction of the elastic limit, but another piece, which had been shortened when hot showed an increae.

By the expression "blue heat" the author meant to include all those temperatures which produced discolorations (ranging from light straw to blue) of the surfaces of bright steel or of iron.

The author showed that steel which had been bent cold, either once or twice, would stand almost as many subsequent bends as the original test pieces. But if the same material was bent once while blue-hot, it lost a great deal of its ductility. Out of twelve samples, in which two preliminary hot bends were made, nine broke with a single blow of a hammer, and the other three only stood one or two subsequent bends. Thin Lowmoor iron did not break quite so easily, but supported about one-half the original number of bends. The following table contained some of these results:

	Lowmoor Iron. 3 16 in.	Very Mild Steel. ⅜ in.	Mild Steel. ⅜ in.	Medium Hard Steel. ⅜ in.
Unprepared or annealed	20	26	12½	21
Broken hot (blue)	3	2½	1½	2½
1 preliminary hot bend	12 mean	11 mean	2 1-6 mean	3 mean
2 " " bends	10 "	⅝ "	⅜ "	⅝ "
1 preliminary cold bend	13	19	9½	20
2 " " "	11	13	8½	19½
4 " " "	6	15	.....	.....
8 " " "			.....	.....

The experiments all pointed unmistakably to the great danger incurred if iron or steel were worked at a blue-heat. The difference between good iron and mild steel seemed to

be that iron broke more readily than steel while being bent; that iron suffered more permanent injury than steel by cold working, but that, if it had successfully withstood bending when hot, there was little probability of its flying to pieces when cold, like mild steel.

It was a common practice amongst boiler-makers to "take the chill out of a plate" if it required a little settling, or to set a flanged plate before it was cold. This was nothing else than working it blue-hot, and should not be allowed. All hammering or bending of iron and steel should be avoided, unless they were either cold or red-hot. Where this was impossible, and where the plate or bar had not been broken while blue-hot, it should be subsequently annealed. It was satisfactory to learn that, since the introduction of mild steel, a practice had been gaining ground amongst boiler-makers, which must have the effect of guarding against such failures, and should be encouraged. It consisted in the cessation of work as soon as a plate, which had been red-hot, became so cool that the mark produced by rubbing a hammer handle or other piece of wood over it, would not glow. A plate which was not hot enough to produce this effect, yet too hot to be touched by hand, was most probably blue-hot, and should under no circumstances be hammered or bent.

The theory that local heating of a plate set up strains which sometimes caused failures did not appear to be supported by the experiments. But it was doubtful whether the proposal to locally reheat a plate, which had been worked when hot, in order to anneal this part, should be carried out. Several test pieces were made red-hot or blue-hot, and then were slowly cooled, by holding one of their edges in cold water. As might have been expected, the medium hard steel lost much of its ductility. The other steels and the iron were not greatly affected, as would be seen from the following table:

	Medium Hard Steel.	Mild Steel.	Very Mild Steel.	Lowmoor Iron.
Unprepared or annealed	21	12⅝	t 26	20
Quenched red-hot in boiling water	24	10	19	20
" cold water	1	10	25 19, 19	37 21, 14
Red-hot, quenched edge in cold water	3	8		
Blue-hot, " "	3	6⅝		

The author concluded by suggesting that the question should be further investigated, and that steel manufacturers should endeavor to ascertain whether every quality of steel was made permanently brittle by being worked at a blue-heat, or whether this was independent of the various impurities contained in it; and also whether prolonged exposure to a blue-heat could produce the same effect.—*Engineering.*

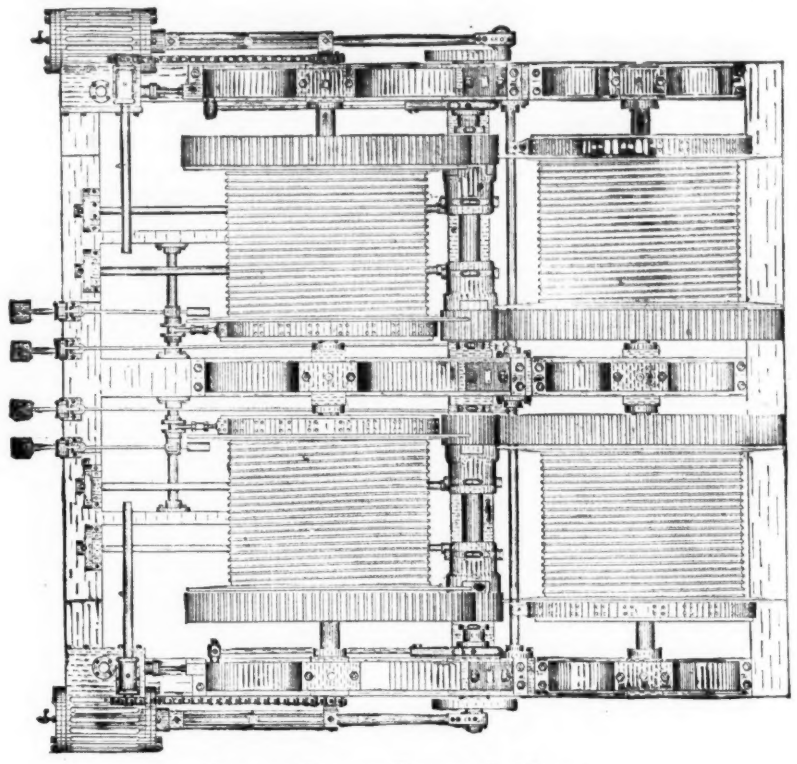
When you are doing a tough filing job, use two or three files. They seem to take hold better and work freer from having a "resting spell." Perhaps it is because different files fit the hand differently, and thus furnish rest and a change.

The Philadelphia correspondent of *Puck* tells about the cable roads in that city, and how the labor of the noble horse is lightened. "They used," he writes, "to be compelled to pull all the cars, and since the cable has commenced running they only pull every other car."

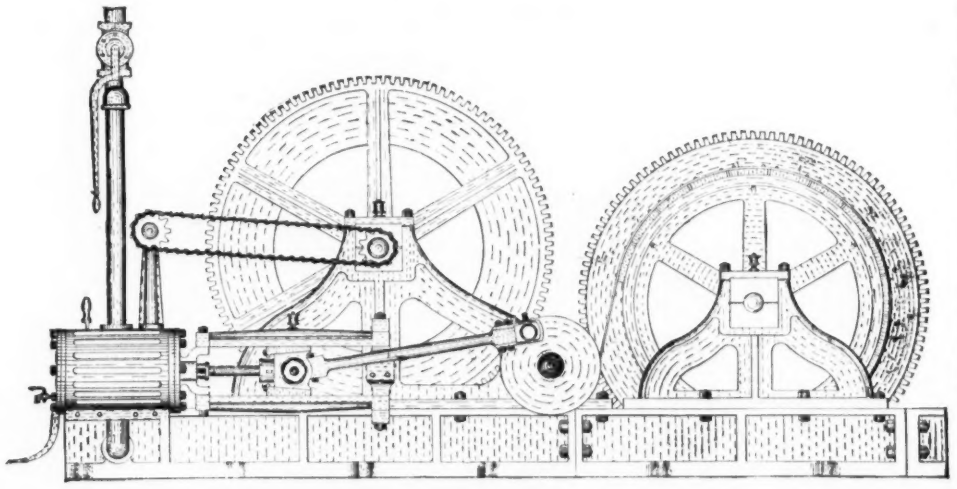
The Patent Shark.

BY GEO. B. GRANT, BOSTON.

My mail, for a week or two after I receive a patent, is a source of much amusement and instruction, and leaves the impression on my mind that the average inventor must be a first-class fool. No other explanation will account for the thriving existence and continued support of the horde of cheap swindlers and industrious humbugs who load me with their flaming advertisements and seductive offers.



PLAN OF HAULING ENGINE—See Page 1.



ELEVATION OF HAULING ENGINE.—See Page 1.

Most of these are agents for the sale of patents, and, let them tell it, have most astonishing facilites for exchanging my invention for tens of thousands of dollars. Their compensation is a commission of ten per cent. on the actual sales, and *a small advance* of five to fifty dollars to pay half the cost of getting out circulars and engravings.

Some have exhibition halls in the center of some great city, where models can be displayed to the gaze of throngs of capitalists who are in search of an outlet for their surplus funds, at a charge of so much per month for the space occupied and the services of the director and his assistants. The cash should accompany the order to exhibit.

A farmer in Canada wrote to me, saying he had sent $30 to a certain company to exhibit his potato digger. He was not overrun with orders, could get no satisfaction from the concern, and thought likely he had been beat. At the given address I found the exhibition hall in a mean fourth-story attic, without a sign at the door, or even a line in the directory; but it was full of models, in rows and in piles, covered with dirt. A rascally-looking fellow explained the matter by saying that he had done his best with the potato digger; but it was a poor specimen, and there was but small demand for potato diggers, at best. His circular would disgust any printer—mere gutter snipes at ten for a cent.

But this was an exhibition hall, open to any one (who could find it), and his circulars were circulars; the law was not broken, and I left the company, hard at work at his desk writing decoy letters to new victims.

A certain "Patent Exchange" named the sum my patent would fetch for each State right: $8,000 for Florida $15,000 for Alabama, and so on, some $75,000 in all. The modest sum of $8, payable in advance, would meet half the cost of flooding the South with my circulars, and the exchange would be satisfied with its final commission of $7,500. Merchants and ministers vouched for the concern; but I kept the patent and the $8.

Another is founded on broader principles. It is made up of thousands of inventors, all working for each other on the "united-we-stand, divided-we-fall" plan, with a code of by-laws, a general manager, and directors everywhere, from Iowa to Hong-Kong. Memberships cost is small and a modest sum will reimburse the general manager for the circulars that are to be sent to all civilized countries.

Very often the concern publishes a periodical, some "Scientific Bamboozler," Vol. XXVI., No. 763, which I never heard of before, but which nevertheless has a circulation which is something immense, and I am furnished with a blank order for advertizing my invention.

Others take the shape of engraving and publishing companies who will send me an engraving of my patent drawing for a couple of dollars, and get out my circulars for about half what I know good ones cost. The engraving is sure to be one of these "cheap and nasty" photo engravings, which excel only on the specimen-sheets of their makers, and the circulars would be sure to kill the invention.

About the cheapest dodge is an offer to furnish me with copies of my patent, "printed from the same type as the original," for about twice the price the Government charges for the same thing, which is itself about twice too much.

One thing I notice particularly, and it speaks volumes. I get no letters from Boston swindlers, although Boston is well represented in the trade. I might call in person, and they much prefer that their patrons should remit by bank draft, or in some such way. If I was a farmer, a thousand miles away, with a potato digger on my brain, and a few dollars in my pocket, I should hear from Boston without fail.

Another set of beats, quite as dead, and much more dangerous, but not as transparent as the patent sellers, are some of the "no patent, no pay" class of patent lawyers, and it is astonishing what a host of ex-examiners, eminent lawyers, and scientific experts, are ready to act as my humble servants, as long as my money holds out. These men will examine into the novelty of my invention gratis, when any sort of an examination is worth at least $10; and they will guarantee to get me a patent or charge me nothing for their services.

The average inventor must employ some attorney, for he is promptly kicked out of the Patent Office, if he applies in person; and as he is seldom able to employ really good counsel, he is almost sure to fall a victim to this ingenious trick.

The secret of this really able racket is that any fairly posted lawyer, or any ex-thirteenth-assistant examiner, who lost his job when his uncle left Congress, can get a patent with a genuine red tape and green seal attached, on any sort of a gimcrack, whether it is new or old, useful or useless, valuable or worthless.

The real patent lies in one or more formal statements or "claims," and not in the specification, or drawing. The Government requires the former to be novel, in form if not in substance, but sets no such limits to the latter, and it is an easy matter to so draw up a claim that it shall be novel, whether the invention is or not. If the claim is rejected, twist it a little, add some technical phrase that totally destroys its value, but which is pure Greek to the inventor, and it will surely pass.

There are thousands of patents on each of the articles in common use, the plow, pump, car-coupler, telephone, etc., and nine out of ten of them have been forced through by cunning manipulation of the claims. It would require a genius to invent a real *improvement* on the plow, but any clodhopper can contrive a patentable *variation* of some detail.

These men make no search, and make no charge for one, for they well know they can dodge any record there may be; and they take no risk whatever by staking their fee on the result.

As an experiment, I copied an idea that I knew was sheer nonsense, from a patent not five years old, and wrote about it to several of the shysters. Each one "searched the records," and would undertake to procure me a patent "on receipt of the first Government fee of $15, and $5 to pay the cost of a (one-dollar) drawing."

The only defence is to let the advertising patent sellers alone, and to employ as counsel some lawyer who charges a fair price for his services, whether successful or not, and who is not obliged to mutilate the patent to get his pay. If an idea is unpatentable, it is worth a large price to have that disagreeable fact demonstrated, and it is poor economy to buy a cheap patent, and then pay a heavy price to develop its utter worthlessness.

Just now there appears to be a genuine "boom" in natural gas. Wells are being sunk in localities where there has been no suspicion of the existence of gas; they don't always strike gas, but boring them makes work, so some good is accomplished.

Splicing Copes.

BY THOMAS D. WEST.

The engraving shown with this, illustrates ideas for splicing together copes to cover moulds which, from their length and the crane arrangement, could not be well handled in one piece; also for saving expense in making new copes for long moulds. By the plans shown, the writer has often, in order to save making new copes, utilized from two to four old short copes upon a single job.

In thus utilizing old copes, all the new work generally necessary to be made for the plan shown in Fig. 1, are bars *R R*, and their insertion.

In ramming up spliced copes, one cope, or section, had generally better be first rammed, in doing which, a straight plank is clamped or otherwise held against the joint end *A B*. When this cope is rammed, this is then removed and a "part" made to ram the second cope against. To insure a good "part," the best thing to use is paper, evenly and smoothly nailed against the joint. After all the sections are rammed, the next thing which naturally follows, is lifting or hoisting off. In lifting off and closing spliced copes, the plan adopted should be different from that generally employed for lifting off and closing single copes. Whether copes are to be guided by "pins" or "stakes," the arrangement should be such (when a straight joint, as at *D*, is used) as to permit of an end movement, as soon as the flask starts to lift. This idea is better explained by noticing stake *K*, seen in Figs. 1 and 2. Here we see that, instead of the stake being set close up against the cope, as is generally done, and shown at *H*, it is kept back about one inch. In driving this stake, a thickness piece is placed between it and the "first cope." Then before starting to hoist this cope, the thickness piece used is taken out; this will then, of course, allow the cope to move endways towards the stake *K*, as soon as the cope starts to lift, thereby preventing "breaking down the joint." If there is then only one section or cope left, it can be hoisted straight up, as in ordinary practice with single-coped moulds. Where there are more than two copes, all but the last to be lifted would, of course, require to be "pinned" or "staked," so as to permit of an end-movement, as above described for "first cope." A plan for staking middle sections or copes will be sufficiently illustrated by the block *N* (which is secured to a cope by bolts or nails) and stake *T*.

It often occurs that the cope-construction of a pattern is such as to not permit an end movement when first starting a cope. To overcome this difficulty, the "parting joint" can be made slanting, as illustrated in Fig. 3, thereby permitting of the "first cope" being hoisted straight up. In some cases, the writer has adopted the slant system of jointing in place of the clearance staking above described, in order to permit straight closing over cores, etc.

The closing of "spliced copes" requires as much consideration as lifting them off; in fact, the former should be given the most advantages, for what "break-downs" may occur in lifting off can be seen and, generally, mended; but let a break-down occur in the final closing of a cope, and the evil done cannot be seen or remedied.

In splicing copes for long moulds it is not necessary that they be all of the same width. All that is required is that the outside frame of the copes be given, as at *D*, Fig. 1, a rigid abutment. To rely altogether upon a sand joint would not be safe. Where one cope is narrower than another, a rigid abutment or joint can be formed by carrying wooden or iron abutting-pieces from the last bar's face to butt that of the narrowest cope's frame.

A crude way by which long moulds may be covered with spliced copes is illustrated by Fig. 2. Here the copes are spliced by driving the jointed copes' ends full of nails, sufficient to carry about 1″ thickness of sand. The sand, after having been rammed, is then made to present a straight surface, by the use of a straight-strike working against guides, nailed at the end of the cope frame. These guides can also be used to answer the purpose of abutments, as called for above. Two ends thus treated and then abutted, should give a joint, sufficiently close for ordinary work. In order to save cutting out that portion of the cope's frame which will come over the casting, and also to prevent the casting's heat from burning the cope's frame, pieces of scantling, *P*, Fig. 2, can be nailed upon all of the frame which is to rest or have a bearing upon the "joint." The thickness of the scantlings can range from 1¼″ to 2″. They should be thick enough to raise the frame out of danger from charring or being burnt; also to give a good chance for gaggering, and security in holding up the sand, as seen at *S*, Fig. 2. Copes thus raised will, of course, require to be well gaggered all over, on account of bringing the "cross-bars" *F* so high above the pattern cope surface.

While the above plans might be said to be applicable to wooden copes only, there are some ideas which, by a little distortion, can be well applied to iron copes. First, for instance, take Fig. 1. Here similar bars as *R* could be made and bolted to the outside of a solid cast flask. What is meant by "solid cast flask" is one whose frame is in one piece, and not bolted together. Where iron copes are made in sections, and trunnions or handles would prevent bolting on similar bars as at *R*, one end could be taken out, and a bar inserted, as illustrated by Fig. 1. To ulilize the ideas illustrated by Fig. 2, use a plank, driven full of nails bolted to the end of the cope.

In order to keep an iron cope frame up clear of a pattern, the "joint" can be raised, as illustrated by Fig. 4. The writer has known moulders to cover work by letting the iron face of a cope frame rest upon the pattern. This plan is one not to be approved of, as it not only chills and marks a casting, but is very liable to crack the cope.

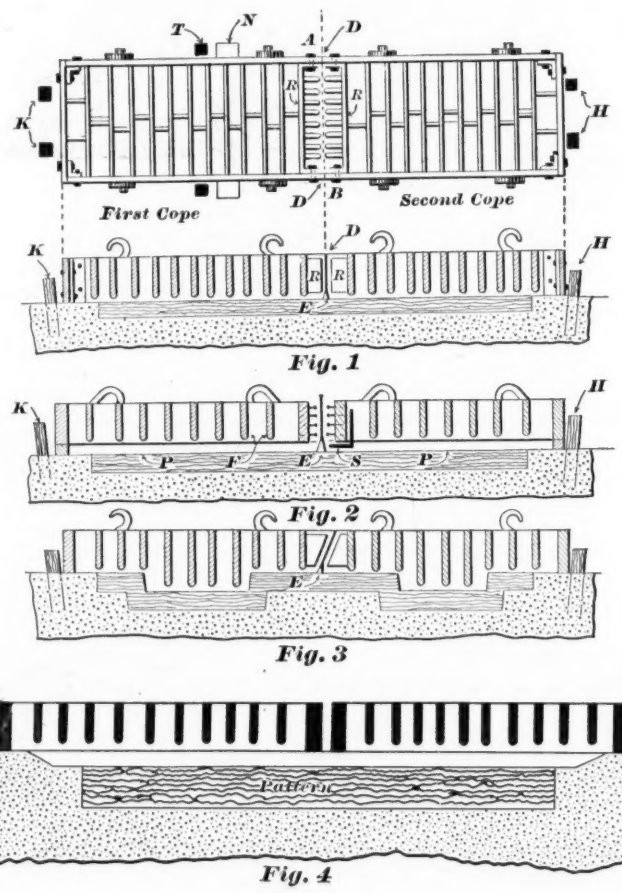
The above idea of "raising the joint" is also applicable to wooden copes, and is a plan the writer has often adopted for raising wooden copes (where the work was of such a character as to admit of using "raised joints"), in place of using scantlings, as above described. The ideas here given will, of course, make it evident that there are no objections to the butting together of iron and wooden copes.

In splicing iron copes, they may, where plain ends are found, often be utilized without the attaching of such bars as *R*, etc. by simply pasting on a thin layer of sand, sufficient to form a straight surface. Could iron copes be found having straight ends, so that when two were abutted together, they would present something near an air-tight surface, the above pasting on of sand might often be dispensed with.

These latter plans are not recommended for work which demands an air-tight mould, or where first-class castings are required. They are only given as a "make-shift" plan for common ordinary long, light work.

The joints of "spliced copes" should be well "finned," similar to that illustrated at *E*, and in closing such copes, all jerking and "overshotness" must be strictly guarded against, in order to prevent crushing of joints.

The term "spliced," here used, is to be defined as applying to conditions which will not admit of copes being bolted together. I am well aware there are a few (so few they can be counted upon the fingers of one hand) foundries which employ an interchangeable system, by which flasks can be readily changed to almost any form; but if they will consider this article as being written to assist those that have not sufficient crane capacity to carry very heavy copes, and also desire to make their present collection of "odds and ends" in copes answer to make castings which may range from fifteen to fifty feet in length, they may find it of some value.



SPLICING COPES.

Old Machinery A Stumbling Block.

Wade's Fiber and Fabric is moved to the expression given below, and the same may be truthfully applied to tools in the machine shops as well as in the factory:

If we could pen all the thoughts on this subject, sent to us from all parts of the country in the daily mail, the owners of old machinery would indeed get their eyes open to the fact that they had in most cases a hopeless struggle before them. With old machinery, the cost for labor is much greater, especially in the spinning room, wool scouring and drying, and cloth-drying processes. Old looms are debarred in competing with new looms on many styles of goods, and in cases where they can compete, they cannot produce as much, or as perfect cloth as our latest looms. Modern wool scouring and drying has become almost automatic, and the cost reduced to a shade of that in old mills with old machinery. In new mills, wool is no longer carried on the back from room to room, but the air we breathe is controlled to transport it in a moment of time; hundreds of feet away over rivers and canals, from cellar to garret, it goes like down in a gale of wind; while in the older plants it is still carried in sheets on the back and by teams—a slow costly process. Old machinery cannot pay as good prices for labor. It cannot, under any circumstances, pay as good a profit; it cannot make as many yards of cloth out of a given quantity of wool; neither can it make it as well, or as perfect, and more imperfections will be made.

Doing Repair Jobs.

BY JAMES F. HOBART.

THE CHIP AND STRING METHOD—THE RIGHT WAY—THE GOOD MAN AND THE SLOUCH—GETTING A GOOD PLACE AND BOUNCING A POOR ONE.

It is usual, among those who use machinery, to employ a man to keep the plant in running order, be responsible for stoppages, and to see that proper repairs are made.

In large concerns this man attains to the dignity of "Mechanical Engineer," and does his work with his head entirely through the medium of a squad of mechanics under his direction.

Smaller concerns may have a "boss" and a "gang;" or, perhaps, a "machinist" does the whole, as well as attending to the nominal duty of "running" the engine.

Perhaps we are dealing with a very small concern whose sole repair staff consists of a "carpenter," who is expected to, and does too, all sorts of jobs that come in his way, from "setting up an engine" to shingling the mill roof.

There are men who can fill such positions—and fill them well. They are an honor to the name of "mechanic." Their stock of tools and capital consists chiefly of brains, and the knowledge of how to use them.

These men, perhaps in the woods or in a wilderness, who, from week to week, keep the old engines and water-wheels turning, deserve just as much, and perhaps more, praise for their achievements than if they directed the vitality of a huge manufacturing concern from a magnificent drafting-room.

The man in the big place deserves all he has got, and if he has worked up from the little concern, then he is all the more worthy of his success, and can fill the higher position to better advantage than if he had never had the "rough and tumble" makeshift experience of the small job.

We know of nothing in the whole mechanical repository which will so put to the test a man's fertility of resource as to be brought face to face with a bad breakdown; knowing that no assistance can be had outside of his tool-chest, the mill junk-room, and his brains.

Let the "old man" say to our (we presume he is young) mechanic, "Well, Henry, can you fix it up?" And Henry's moral courage rises like the thermometer in a boiler-room.

It is these rough experiences with repair jobs which develop that confidence in oneself which is so valuable in emergencies.

This kind of an education may not be deemed as desirable as a course in a technical school, the student may not step as easily into the grooves of practice in the big establishment, but the solid stratum of experience thus gained will prove of incalculable value in after life.

There are two ways for our young man to choose from while he is patching old belts, babbitting boxes and keeping shafting in line, and whichever method is chosen *now* will be followed even after promotion has been made to the care of thousands of horse-power.

The ways are these: Our man may get into the habit of *temporarily repairing* a breakdown. He will then just "patch it up so it'll run," and wait until another break before putting on another patch. When a bearing gets cut out, and a journal is "down," he will not trouble just now to repair it thoroughly by new-lining the box; instead of that he will patch the job with a "chip and a string," in hopes of "keeping her moving" until "week after next," when they are going to "shut down for repairs." Such a policy is always a ruinous one.

It runs down the plant worse than all the wear of work, and no one connected with, or dependent upon, the concern can safely calculate upon getting through a day when there is a "rush of work" without having one or two exasperating little breakdowns which make necessary "another chip and another string," in order to "run until night."

Now let's look at the other way: Here we hardly ever have a breakdown. Everything runs smoothly and wears well. Our repair

man is always hard at work, but somehow he never has a case on his hands where he must work like a beaver, while all hands idle around until he patches up the old engine so 'twill "run till Sunday."

When our man repairs a thing he repairs it for all it is worth. He looks right down to the root of the matter and screws up all his bolts to stay.

He never slights a job for the sake of getting started eight minutes sooner. He has figured out that by so doing he is liable to shut down ten times as long to repatch, before he gets a chance to do a permanent job, if such a chance ever comes.

Another result of the last method is that there is hardly ever a breakdown. Henry has a habit of fixing weak places rather than breakdowns.

If a gear shows signs of wearing out, a new gear is immediately obtained, bored, splined, and laid aside with the assurance that it is of the right size, and is ready for instant use. According to the first method of "doing repair work," the gear would not have been looked at until the teeth had worn thin and broken off. Then there would have been rushing to and fro; a hunting for an old gear which, according to a misty recollection, was "just about the size" of the broken gear, and when found, by means of lusty bushing, was made to wobble in an eccentric manner around the shaft until a new gear was cast and bored.

Our brainy repair man has got his gear all ready. He does not wait for a break. He keeps an eye upon the failing factor, and just at the right time, when everybody is eating dinner, the new gear is slipped into place, the key driven home, and hours of costly vexatious delay is saved by fifteen minutes' use of a few first-quality brains.

There are thousands of places around the shop and mill where a little repairing, "just before it is needed," will save lots of dollars.

See that safety valve? A little blue streak of steam blows through one side of the valve. That valve should be ground at once or a big pile of coal will sneak out of that little hissing leak.

A steam-valve blows just a little. One-eighth of a turn with a monkey wrench will stop that leak, save the steam, and add to the life of the valve by preventing any cutting of the stem by the hot steam.

Down in one corner of the wheel-pit, a thin stream of water squirts out and spatters a belt. It is an easy matter to nail a piece of a barrel head over the stream of water in such a manner that the belt is protected. Don't do it; that is the "chip and string" method. Get Henry to attend to the matter, and note well his method.

"How did that leak originate?" Was his first thought. The flume has become weak, it has yielded to the pressure, I must get it back into place, and then stiffen it so it will stay there," were the thoughts which naturally came next. A long auger was procured, holes bored through the flume posts, a bolt put in, a jack-screw and shore was rigged against the bent post just before one dinner time.

"Can't get that post back until the dirt is cleaned out of the crack between the planking," was the next thought in order. So the head gates were dropped at noon, the water drained through the wheels; the flume entered, all the dirt removed, which had been sucked in by the water; the jack-screw tightened until the post was in place, when the bolt was screwed home and the job was done.

This method cost much more than the barrel head method, but it added a month to the life of the flume and saved enough water to run the mill one day more in the dry season.

The two methods of repairing described above are typical of two kinds of mills. In the one, every piece of machinery is always ready for business, and never gets "on a tearing scrape" to the detriment of much time, temper and oil, which are required to get the thing into "good nature" again.

Machinery never seems to wear out in this mill. Everything is snug, and fits as well as the day it was first started up, and the machinery seems even better than when new.

In the "chip and string" man's mill everything is different. Every machine seems to know the difference, and appears just ready to fly all to pieces. There is nothing solid here. Everything is "hanging by the eyelids;" nails try to do the duty of bolts, patches are seen where a new article is demanded, while the whole place has the appearance of being just ready for cutting up into junk-shop lots to order.

It is not often that the patch repair man gets a chance to "come up higher." He often wants to do so, and sometimes gets all ready to take advantage of a chance which he thinks will come along. Just then, however, like the horse who was educated to live entirely on sawdust—but died just as his education was completed—our man's employer fails up, the old mill racks entirely to pieces, or spontaneous combustion ensues from contact between some of the innumerable patches, and our man is out of a job again.

Sometimes the patch-work man comes along to our mill and wants a job. We want men, but we *don't* want this kind, and so we tell him that we have no work for him.

How are we to tell this kind of a man?

Easy enough. Just get a glimpse into his tool box and you can sum up that man with micrometer exactness. His hammer handle is cracked, his cold chisels are dull or full of nicks. His square has the corners all worn off. His straight-edge has had a fall, got sprung, and bears hammer marks of an attempt to straighten it. Calipers are bent out of shape, dividers are minus a screw, while the bottom of the box is a rat's nest of dirt and litter.

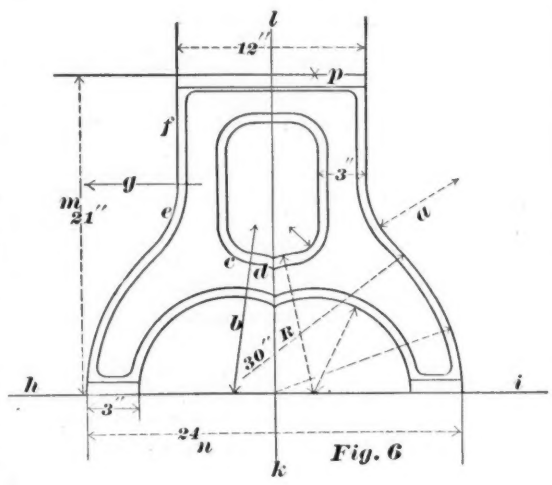


Fig. 6

Now take a look at another kit. The box is clean and looks as if it had just been filled from the show case of a tool dealer. How clean the hammers are. Their handles are small, clean and bright as if just shellacked. The owner has had that cold chisel two years, but it looks brand new. You never saw a head of jagged steel battered down around the end of that chisel. The head gets ground when it needs it, just as much as the cutting end does.

This man has been with us a year, but he is working his notice now. We are sorry he is going. He is a splendid hand. He "knows how," and does work so that it will stay done. One day Mr. Ironman was down to our mill. He got a glimpse of that tool chest, quietly made enquiries, and kept his eye on the young man for two or three months. One day he asked us if we could spare him. We were sorry to lose him, but said "yes" right off, for it was a chance for Dan, who takes charge of Ironman's plant next month, at $1,200 per year to begin with.

"That sounds all well enough when you tell it," says young Cogdriver from Scatterdown's mill. "But you ask our 'old man' once or twice for the wherewithal to make a good job of any repairs around his mill, and you never will believe your own story. Why, the way that man will disperse himself around that mill, would be so suggestive that you would never ask him again for anything to do with."

Cogdriver is right. There are many men like Scatterdown, but diplomacy will work wonders with most of them. Make them see that it is for their interest, and they are on your side to the last.

Some mill owners, however, are beyond the reach of reason in this respect, and when the young mechanic finds himself in the employ of such a man, and when by pursuing a judicious policy, no change can be made for the better, then that young man should *get out*. He owes it to himself that he seek a place where he is not being constantly degenerated into becoming a "chip and string" patcher.

There are plenty of places where a young man is wanted, and if the young man is bound to do things right, the desirable places will never keep themselves long hidden.

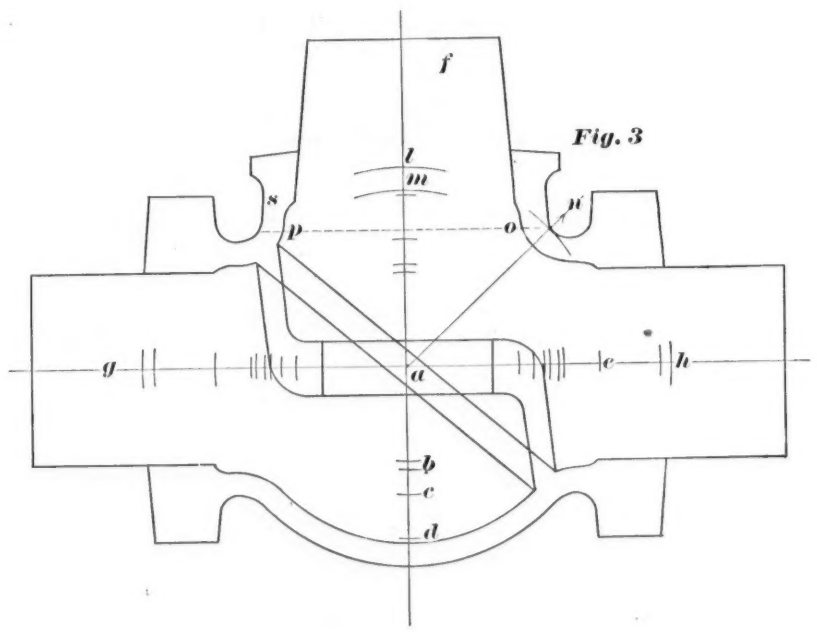


Fig. 3

Cutting Off Steel Rails.

The Troy *Evening Standard* tells about a new application of the revolving disk for cutting cold iron, whereby Bessemer steel is used instead of wrought iron for the disk. The tremendous speed necessary to make the disk cut the cold metal, has hitherto been a source of danger by causing the disk to burst when it becomes heated from the friction of work. The *Standard* says:

A saw without teeth that will cut a steel rail in two in two minutes can be seen in operation at the Central Hudson shops in Greenbush. The saw is run by a 90 horse-power engine, more power than is required to run all the other machinery in the shops, and is 38 inches in diameter and $\frac{3}{8}$ of an inch thick at the edge. The disk is made of Bessemer steel, and runs at a very high rate of speed. While in operation a band of fire encircles the saw and the many sparks flying from the revolving disk resemble a display of pyrotechnics. Michael Gavagan has charge of the machine and recently adopted a new plan of keeping the saw cool to prevent it from cracking. A tank of water is placed above the machine, from which a small stream runs down and drops on the saw while it is in motion. By this plan, one saw will cut nearly 3,000 rails before it is worn out. A steel rail, after about six years' constant use, becomes battered at the ends, and by cutting them off the rails can be used in branch and switch tracks. Rails are cut by this machine for the whole line of the Central Hudson railroad. Several car loads were received from Rochester a day or two ago, and after being cut were returned to that city. The saw, while cutting, bears down hard on the rail, the end of which is left as smooth as the bottom of a flat-iron. One remarkable thing about the machine is that the chips cut from the rail fly back under the saw with such force as to form a solid piece of steel nearly as firm as the rail itself.

Pattern-making.

By F. W. Barrows.

FOURTH PAPER.

DRAWINGS FOR PATTERN-MAKERS.

I would like to say a few words to the draftsmen who do not understand pattern-making, or else do not consider the feelings of the pattern-maker. As a rule, the drawings are too nicely finished; that is, there are no foundation lines left, except such as may form a part of the necessary lines. Even the centers of curved lines cannot be found, because they are not marked; and if you allowed the dividers to make a visible hole, it would look bad, so the pattern-maker must find these points by trial, or guess at them.

Supposing you wish to make a drawing like Fig. 6, what harm can it do to mark all the radii as I have shown, which, of course, locates the centers, or in any other way that will locate them? If I wanted to turn all the flanges or ribs, I should want the centers, in order to locate the joint between two pieces of different radii, as on line *b*, which, being drawn from the center of curve *c* to center of *d*, locates the point where one curve will run smoothly into the other; or at *g*, drawn from center of *e*, at right angles with *f*, marks the right place for joint between *e* and *f*. If you should leave a base line at *h i* and a center line at *k l*, they would not necessarily affect the accuracy of drawing. Unless you make a full-size drawing, the pattern-maker will probably make one himself. Then your nice scale drawing is of no more use than a few chalk marks and figures on a piece of board.

It is also best to mark all dimensions in plain figures, as at *m* and *n*. Note where finish is to be allowed, as *a p*, and state how much is to be allowed for shrinkage, whether the casting is to be brass, iron or steel; in short, if you are going to make a drawing for pattern-maker, make it so that it will answer all questions necessary for the pattern-makers to know the answer to.

There is another kind of drawing, which is sometimes made for small work, such as brass steam-fittings. It is customary to lay the pattern to test its accuracy; so, if you wish to please the pattern-maker, and yourself also, you will take pains to have your drawing true. By this I mean that the centers of core-prints *g h* in Fig. 3, and the center of globe, will all lie in one straight line, and this line shall also pass through the center of neck at each end. Also the centers of squares, and the hub end, should be exactly at right angles to this center line, and central with the globe.

A good way to accomplish this is to make the drawing as I have shown in Fig. 3. The sizes or dimensions are all measured on the two central lines *l d* and *g h* from one center, which is the center of ball at *a*. As these dimensions are all laid off by dividers, from the same center, it is evident that the central line of ball will also be the center line of every part; and any part that should be alike at both ends of the body, as the squares, will be so, and will also be equally distant from the center of ball. Now the pattern-maker should be able to make a pattern fit a drawing like this. If you will also mark the points *l m*, it will be handy in taking the size of body and core, and make a line from center of fillet, where neck joins body and center of ball *a*; this locates the joint between hub and body, as line *o p*.

Primary Causes of Fires.

The Home Insurance Company, of New York, has prepared a diagram, graphically illustrating the comparative number of fires by ascertained primary causes, in the United States during the year 1884, which would have been more complete, had the number of degrees assigned to each cause of fires been marked on the rim of the circle, and not left to measurement or guesswork. The diagram will prove useful and interesting. It assigns to incendiarism in the broadest sense about 107° of the circle. Defective flues occupy 40°. Friction in machinery, as nearly as can be estimated, is responsible for about 4° of the circle, while boilers and steam pipes get credit for a small segment of only 2° or 3°. Spontaneous combustion is credited with about 10°. A noticeable feature of the diagram is the large proportion of fires occurring from strictly *preventable causes*, the major portion of which could have been avoided by the exercise of ordinary prudence and foresight.

From a pamphlet accompanying the diagram, we take the following extract, as indicating methods of prevention:

To avoid accidents from friction of machinery, high-grade oils should be used, with self-oiling bearings. The shafting should be kept true and in line. All accumulations of dust, dirt, flyings, etc., should be frequently removed from bearings, to prevent undue friction, as the heat thus generated may remain latent for some hours after the machinery has ceased running, and burst into flame when least expected; hence all important bearings should be frequently inspected during the first three hours *after shutting down*, in order to prevent disaster from this cause.

To avoid danger of fire, steam pipes should never be allowed to come into contact with wood or other inflammable material. When passing through floors or other woodwork, they should be provided with metal collars, having radial points or arms extending from the inside, so as to form an air-space around the pipe. When hung on the side-walls of an apartment, they should be supported on iron brackets, and be kept free from all accumulation of inflammable material. When laid near the floor, as in dry rooms, the floor should be covered with metal, and the pipes be raised above it at least three inches, and be laid in sections, resting on pieces of piping of 1 or $1\frac{1}{4}$ inches diameter, thus giving a free passage of air under the pipes, at the points of contact with their supports; there should be sufficient space between each section, to allow ready access for removal of waste, dust, etc. The safest, and at the same time the most satisfactory, method of heating by steam pipes, is to suspend them in iron stirrups, at a point some two feet below the ceiling. When so arranged, the heating capacity is not in the least diminished, while cleanliness is conserved, and the danger of fire from an accumulation of combustible material on the pipes is almost entirely eliminated.

Nearly all animal and vegetable oils, in combination with animal or vegetable fiber, will ignite spontaneously under favorable conditions, as will also lamp-black, charcoal and some kinds of bituminous coal. It will thus be seen that where oils are used, the danger of fire is imminent, and the only safeguard is to *at once burn* all oily, greasy or paint rags, waste, sawdust, etc., when no longer needed for use. They should be kept in metal receptacles, and removed from the building every day, and never be left on floors, under benches, etc., over night. painters' overalls should be hung up in such position as to permit a free circulation of air about them, as they are iable to ignite spontaneously, if allowed to lie in heaps on the floors and benches.

Mineral or earth oils have not as yet developed this quality of spontaneous combustion, but a due sense of caution would suggest that they be treated with the same rigid care, so essential to safety with oils known to possess this quality of self-ignition.

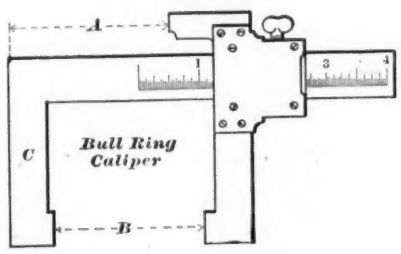
The *National Car and Locomotive Builder* says: "There are only two coal-burning locomotives on the Burlington and Lamoille Railroad, where Mr. F. G. Brownell, is master mechanic, but they are operated on the smallest fuel consumption of any locomotives we know of. The road is far from the coal-supply centers, and the fuel costs $4 a ton delivered on tenders, so there is a strong inducement to exercise care in its consumption. One of the engines having cylinders 17x24 inches is employed in pulling a mixed train, and the consumption of coal reported is 25 pounds per train mile. The other engine is used exclusively for passenger service. The cylinders are 16x20 inches. This engine is reported as using 20.5 pounds of coal per train mile. The cost for other supplies and repairs is proportionally low.

LETTERS FROM PRACTICAL MEN.

Bull-ring Caliper.

Editor American Machinist:

I send you a sketch of a very handy little tool for calipering bull-rings and transferring a scant size to the piston head lugs. It is generally customary to leave the lugs a little scant of the bull-ring, so the plate will draw the ring; hence this tool. I caliper the ring



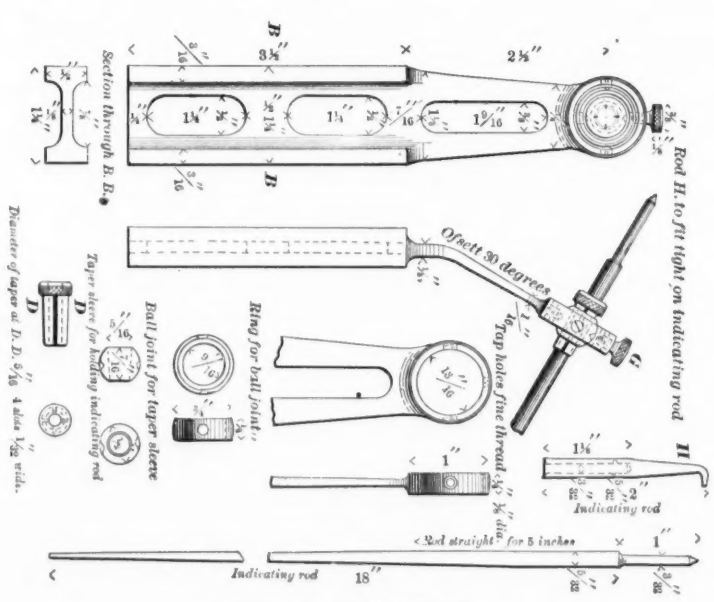
with jaws B, distance A being a fraction less than at B; consequently, by turning caliper over and placing back C against the flange on head, I have the distance at A, which should be the length of lug. The distance A is always scant of B, as no matter what the thickness of bull-ring may be, A registers scant.

LEE C. SHARP.

Indicator for Lathe Use.

Editor American Machinist:

This is an improvement on other indicators of my design, which have been previously illustrated in the AMERICAN MACHINIST. Generally speaking, indicators for lathe use have been designed for the purpose of truing work on the face-plate, from the fact that work which is to be trued up on the face-plate consists of a series of center punch holes, locating desired distances as the case may be. When strict accuracy is required the indicator is resorted to, and the fact of the point of the indicating-rod being



INDICATOR FOR LATHE USE.

inserted in the fine center punch mark, has given the instrument the name of center indicator. In this class of indicators some are made with a ball joint and ring, as shown in the drawing; this is the only correct principle, inasmuch as this form admits of changing the instrument from a center indicator to one for truing holes and work upon the centers by the addition of the screw G in combination with the short rod H. By inserting this rod in connection with the long rod into the center hole of the live spindle while in motion, it will show whether the spindle runs true. The screw G should be adjusted to stop the movement of ring connecting the ball joint, as but one movement is needed when truing work upon centers; place the point of the bent rod below the line of centers against the work, and if in truing work such as lathe spindles, after boring or reaming the taper hole, or in counter bores that are to have changeable sizes of leaders, the centers should be scraped until the rod ceases to vibrate.

When using the instrument for outside work bring the offset part in line with the centers. To those who have never used a center indicator it is well to remark that when the point of the rod is inserted in the center punch hole a slight pressure should be applied to the instrument, and the carriage fastened so as to keep the rod in place. Too great a pressure will be liable to change the fine center punch mark. As the work runs out tap it lightly until the rod ceases to vibrate. Have the distance between the point of rod in the work and ball joint as short as possible; this will give a greater vibration of rod. Improvements not patented.

Somerville, Mass. C. E. SIMONDS.

Jamb-Nuts.

Editor American Machinist:

James F. Hobart's remarks on jamb-nuts (in your issue of February 13) are well put. They remind me of an additional error I have frequently noticed in jamb-nuts, and that is that they are frequently made thinner than the regular nuts, owing either to stud or bolt being too short, or so made to prevent too much projection. These thin nuts are put on top of the regular nut, which, in order to be a jamb-nut, receives all the strain. The thin nut should always be below.

A. B. LANDIS.

Testing Oils.

Editor American Machinist:

Since your publication of my article on oil tests, January 9th, I have received several communications about it asking for information.

I sought some simple means of testing the great variety of oils offered to our company, hence the simple machine illustrated in your January 9th number. Oils are divided into two great classes, fat or fixed oils, and the essential or volatile oils. These, when in a solid form, are known as fats; when liquid, as oils. Out of twenty-four samples of oils, tested at the Brooklyn Navy Yard, it was found that no oil or mixture of oils would lubricate under pressure as well as sperm oil, the rank being as follows: Summer sperm, winter sperm, Mason's extra sperm, neatsfoot-oil, lard, tallow. Oils may be tested by placing a few drops of each kind to be tested side by side with pure sperm on a plate of polished metal, say brass, tin, or glass, then raise one end to give it an incline and note the time in flowing a given distance; also by putting them out in the sun and air, and finding their tendency to gum; or by having a brass box or gearing, and a shaft and journal turned to fit it nicely, and fix a lever from back of lathe rest, and on the other end hang a weight heavy enough to raise the temperature when the journal is set in motion. Different speeds can be used by changing the belt on the cones of the lathe. Bore a hole large enough in lever over center of brass to put bulb of thermometer in to note the rise of it. I could make a common lathe as good a tester as I would want. After getting up all the rig, I would get the best sperm oil to use as a standard to test other oils by. The ones having the greatest amount of fixed oils or fat in them will be the cheapest, if they do cost a few cents more per gallon.

For a railroad company I think the best plan would be to have a journal the size used on passenger or freight cars, and by lever and weight put on the same pressure per square inch as the journals in use on the road are subject to, the journal revolving at the same speed as while in service. As the coefficient of friction depends upon the nature of the ungent, these practical tests are the only ways by which we can come to the true value of the oils offered for sale.

Another very simple test for oils may be made by placing a long polished bar, say a locomotive guide bar, at a certain incline, and put a polished block on it, and note the time it takes to slide from one end to the other, with the different kinds of oil at different angles.

J. J. BINGLEY.

Shop Writing.

Editor American Machinist:

A recent article in a trade journal contains some strictures on mechanical writings in shop parlance. They are not as strictly grammatical—finely put together—as the writer of the aforesaid article seems to wish. Though neither a machinist nor an engineer, but simply a rolling-mill man who can appreciate a good thing, I feel constrained to take up the cudgel in defence of this kind of writing. Workmen are not desirous of having a good point so hidden under grammatical phrases as to be undiscoverable; there has been too much of this in the past. It is a comparatively short time since men of practical knowledge began to write articles on shop subjects, and the fact that they are written in the language of the shop only increases their merit and interest. Such a method of writing renders matter, which told in any other manner would often prove tiresomely dry, amusing as well as instructive, and it is undoubtedly often read by many, from whom the mere technical presentation of the subject, with its polysyllabic language would not receive a second glance.

Observing men of all trades pick up valuable information daily, and what one may miss another sees. We are all learning, or ought to be, no matter if some of us because we are in charge of works imagine that our heads are abnormally larger, and that knowing it all, we do not need pointers from others.

Telling a good thing in language readily understood by those for whom it is intended, is only secondary in importance to the thing itself, and if at the same time amusement is furnished along with solid fact, a two-fold good is accomplished. Take, for instance, the letter of "Chordal," on "Morin's Experiments on Friction," published in the AMERICAN MACHINIST some time ago. How many hundreds of machinists and others, received their first correct idea of the principles of friction from that letter? I don't mean our book-learned mechanics, who served their apprenticeship in the college machine shop, and who are a minority, but the every-day hammer and chisel men, who don't wear paper collars under their jumpers, and who are in the majority. To them reading what "Chordal" told about friction was a real pleasure, whereas to have read understandingly the very same thing from the pen of Morin would have been a dreadful grind, and, in all probability, nine out of ten would never have read it all.

THEO. D. MORGAN.

Weighing by Displacement of Fluids.

Editor American Machinist:

Sterling Elliot, in late issue of your paper, says: "The idea [weighing by displacement of fluids], is extremely old, over a hundred years to my knowledge." I say in my paper, "this idea though old as Archimedes," etc. The extract should have read, "graduated to $\frac{1}{64}$" instead of "$\frac{1}{16}$" as incorrectly reported.

The paper in question was widely noticed, but not by my authority, the Society requiring publication in the journal of the Associa

tion of Engineering Societies, New York, before it can appear in other journals.

Mr. Elliott will learn, by glancing at the paper as published authoritatively, that his strictures were anticipated and that accuracy *is* required in stove patterns as now made, the work being of equal importance with the "weighing of scrap."

JOS. LEON GOBEILLE.

A Correction.

Editor American Machinist:

In your No. 8 issue, W. E. Crane calls my attention to an error in piston speed per second published in No. 6. It should be, as Mr. Crane says, 14.18 feet per second, instead of 10, which changes the consumption to 22.34 + cubic feet of steam per second, making the port area

$$\frac{22.34}{100} \times 144 = 32.17$$

instead of 22.689 +.

RALPH E. STATE.

Locomotive Spark-arrester Castings.

BY ROBERT E. MASTERS.

SECOND PAPER.

Fig. 1 is a sectional view of the plan, Fig. 2, from *A* to *A*, showing the moulding of the core *B* and the volutes *C C* (of which there are six) in one piece.

In ramming up the drag, all the sharp corners of green sand between the volutes are well secured with rods, and the whole thoroughly vented before turning over. The ring-bolt *D*, of 1″ wrought iron, is 4″ in diameter, and is cast in the cone for the purpose of handling when in use. This ring is supported in the cope by a hook and rod, as seen at *E*. Suspended in this way, it helps to support the body of sand at *D*.

After the cope has been lifted off, the screws *F F*, Fig. 2, which fasten the volutes to the core, are taken out and the core drawn out of the sand. This leaves the volutes so they can be drawn out separately, and, if there are any soft spots or places on the surface of the mould that need finishing up, it can be readily done. After the volutes have been drawn out, a $\frac{1}{4}$″ rod is pushed down to the bottom board in three places in each of the prints for the volute cores, and a rod shoved in through grooves cut in the bottom of the flask to meet each of the perpendicular rods, as seen at *G*, to form an escape for the gas from the cores.

These volute cores are the same shape the whole depth of the casting as inside of the dotted lines from *H* to *H*, Fig. 2, with the exception of an arm, *I I*, Fig. 1, at the upper part of the core, which forms a scroll in the under part of the core from *J* to *J*, Fig. 2. After a thin coat of paste is put on the bottom of the cores, they are set in their places and secured by shoving three tenpenny nails, at an angle, into the green sand in the drag, letting the heads of the nails extend over the dry sand cores, as at *K*, *K*, *K*, Fig. 2. After cutting the gates, which are plainly shown in the plan, the surface of the mould is skin-dried; it is then ready to close and pour.

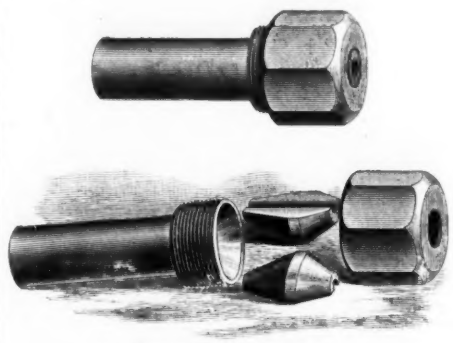
Previous to making these castings in the manner described, each of the volutes and core were cast separately. It kept a skilled moulder very busy to make five of these volutes, with a scroll attached to them, in a day, and a good portion of the following day to make the sixth volute and the core, besides the time required in the machine shop of fitting and fastening the volutes on the core.

The casting, as here shown, was made in less time than it took to make the five volutes, and the work in the machine shop was entirely dispensed with.

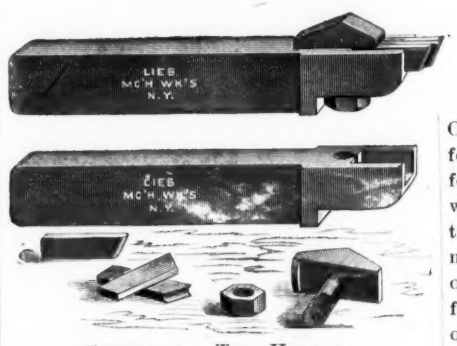
After I had made the steel car-wheels from scrap steel, mentioned in the AMERICAN MACHINIST August 15, 1885, Mr. Albrecht, the inventor of the spark-arrester, told me he intended to have them made of cast-steel scrap, as they could be made lighter, and would resist the action of the sparks and not cut through as quickly as those made of cast iron. I am not prepared to say whether this was carried into effect or not, but there is not the slightest doubt but what it could be.

Some Handy Small Tools.

A combination tool-holder which we illustrate in connection with this description, is intended for use on either screw machines or lathes and planers. It admits of making the forming tools of such shape that they will conveniently do the work in hand, and also obviates the necessity of reforging the whole



TWIST DRILL CHUCK.



COMBINATION TOOL-HOLDER.

tool when a small corner breaks off. In connection with this holder, the weak parts of the tool can be made separate, and if destroyed may be replaced, as stated above, without the loss of the whole form. They are made in two sizes, $\frac{5}{16}$″ and $\frac{1}{2}$″.

The twist-drill chuck, also illustrated, is designed for use on screw machinery for holding a drill when only a short portion can project beyond the chuck. The old way was to break off a piece of the drill, a method at once expensive and destructive. This chuck will hold firmly and truly on any part of the twist, therefore a drill may be used until it is entirely used up by repeated grindings. The chuck is made of steel throughout. The bushings are hardened, and are interchangeable so that different sized drills may be held by the same chuck. We also illustrate a "type-high gauge," which will be of value to all machine manufacturers in testing the cuts used in illustrating their products. A thick or thin electrotype is an evil to be avoided by the use of these gauges.

The three tools above described are made by the Lieb Machine Works, 27 Vanderwater street, New York.

The Rev. Philip Neale, in writing of the inundation resulting from the earthquake at Java, instances as the great force of the waves, the fact that he observed immense rocks of twenty or thirty tons' weight, and some twice this weight, that had been carried two to three miles inland.

It is said that the Chinese and Japanese Governments are making translations of text-books of science, to be sold at a very cheap price.

Setting Valves of Corliss Engines.

As an answer to numerous inquiries about setting the valves of Corliss engines, inquiries coming mostly from parts of the country where engines of this type are just coming into extensive use, we publish the following from the catalogue of the Fishkill Landing Machine Company:

"Take off the back bonnets from cylinder, and notice that the lines marked on the valves and on the cylinder are the lines of opening.

TYPE-HIGH GAUGE.

On the back of hub of wrist-plate will be found a center line, and a line will also be found on the corresponding hub of stand which supports the wrist-plate; when these two lines meet, the wrist-plate will be in its midway or central position. On either side of center line of wrist-plate stand will be found another line, which marks the vibration of wrist-plate, and when center line of wrist-plate coincides with either of these lines it will be in its extreme position.

"Place the wrist-plate in its central position, and, by means of the adjusting nuts, make the lengths of the valve connections such that each steam valve may have the proper amount of lap—say, from $\frac{1}{8}$ inch in a small engine to $\frac{3}{8}$ inch in a large one—and that the exhaust valves may be just ready to open, or without any lap. Then connect the eccentric-hook to its pin on the wrist-plate, and turn the eccentric around loose on the shaft, and, if necessary, adjust the length of the eccentric-rod so that the center mark on the wrist-plate will vibrate to the lines of extreme travel marked on the stand. Then place the crank on either dead center, and turn the eccentric on the shaft, in the direction in which the engine is to run, enough more than one-quarter of a revolution ahead of the crank to show an opening or lead of the steam valve nearest the piston of from $\frac{1}{32}$ to $\frac{1}{16}$ of an inch. Then tighten the set-screw in the eccentric, and turn the shaft with eccentric one-half revolution in the same direction, and notice if the opening or lead is the same as on the other steam valve; if not, adjust it by making its connection either longer or shorter as may appear necessary.

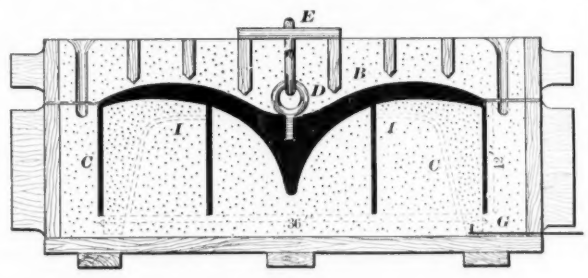


Fig. 1

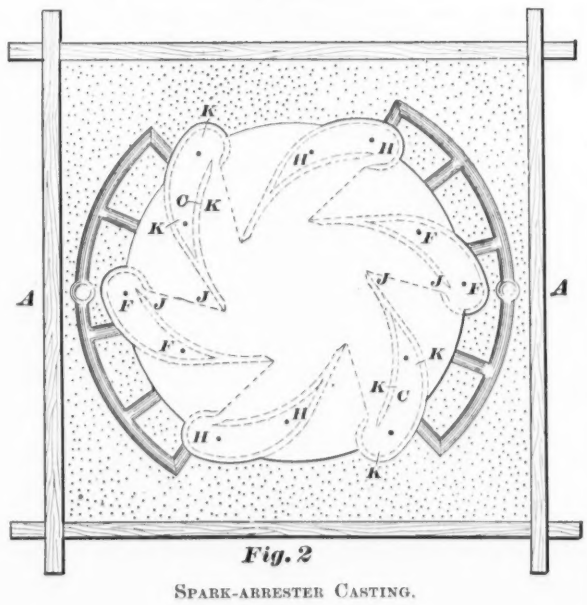


Fig. 2

SPARK-ARRESTER CASTING.

"To adjust the cams for disengaging the steam-valve hooks, let the governor balls remain in their lowest position, and move the wrist-plate to either extreme of its travel and hold it in this position; then lengthen or shorten the cam-rod for the steam valve at opposite end, (which will then be wide open), so that the steel cam on the brass cam-collar will touch the curved arm of the cut-off hook; move the wrist-plate to the other extreme of its travel, and adjust the other cam-rod in the same manner.

"To prove the correctness of the cut-off adjustment, raise the balls of the governor to about where they would be when at work, or to a medium height, and block them there. Then, with the eccentric connected to wrist-plate, turn the engine shaft slowly in the direction in which it is to run, and, when the cut-off hook is detached by the cam, measure upon the slide the distance the cross-head has moved from its extreme position. Continue to turn the shaft in the same direction, and, when the other cut-off hook is disengaged by its cam, measure the distance the cross-head has moved from this extreme posision, and, if the cut-off is equalized, these two distances will be the same. If they are not, adjust the length of the cam-rods until the points of cut-off measure alike.

"Wherever convenient, it is desirable that an indicator be applied to the engine when at work, and this setting of the valves tested and more accurately adjusted, so that the engine may be in the best possible condition for economical work."

Babbitting Loose Pulleys.

Sometimes a man brings a worn-out loose pulley into the shop, and insists upon having it babbitted.

At best, this is a doubtful method of repairing such a job, but, if done right, it will give fairly good results. Never attempt the job, however, if you cannot get at least $\frac{1}{4}$-inch of babbitt all around the arbor.

To prevent the bushing from being loose, use a percentage of antimony in the lining, sufficient to give the alloy an expansion when cooling, instead of having it shrink at that time.

Pour the metal as cool as possible, for metal of this class seems to shrink more when poured red-hot than when poured dull. Drill or chip a number of places in the hub sufficient to hold the babbitt in place. True the arbor fairly, but don't be too particular in this respect. After pouring, and getting out the arbor, chuck the pulley and bore it out true. In this manner, and by this only, can a fairly decent job be done at babbitting a loose pulley.

A well-known manufacturing company write us:

"We contemplate building an iron foundry which, from the nature of its construction, must have a wooden floor as it will be in the second story with a basement below used for rattle boxes, grinding rooms, storage, etc., etc. We had thought of first laying on the joists a plank floor 1½ or 2 inches thick with edges either jointed or matched, as would be best, and on top of that placing a thick coat of coal tar; on that we thought of laying a thickness of 1-inch boards, and on top of that another coat of thick coal tar, and then placing a covering of clay, say 2 inches deep, and then the usual sand used in our foundries.

"Of course it is our aim to prevent rot as much as possible, and we thought that the coal tar applied as above would accomplish this object as well as anything we could use.

"What do you think of our proposed plan, and have you anything better to suggest, not involving too much outlay?"

We insert this in the belief that some of our readers may be able and willing to communicate experience in the above direction.

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About Corliss Engines.

One of the notable features of the steam-engine business at the present time, is the disposition observable among a good many engine builders, most of whom have heretofore done "a near-by trade," to turn their attention from the old form to the automatic cut-off style of engine. Just now quite a favorite pattern among some of these establishments appears to be the "Corliss," doubtless in part owing to the generally good reputation of this type of engine, and in part to the opportunity afforded by the expiration of the original patents. The tendency to change from the building of ordinary to cut-off engines is one that may confidently be expected to increase, as it is, beyond doubt, an indication of the steady advance of mechanical knowledge among steam users, accompanied by a correspondingly higher standard of requirement. Not all the builders of cut-off engines, however, are as frank as a firm in a Western city, which advertises "—— Corliss Engines, Newark, N. J. Designs," the dash given in our version, representing the name of their own city.

The apprehension has been expressed among some steam-engine builders, that, with so many shops turning out "Corliss" engines, under circumstances requiring close competition, some would be likely to do bad work, thereby injuring the reputation of this type of engine. To an inquiry upon this subject, one of the heads of a prominent concern, building Corliss engines largely, replied recently that their firm had no fears upon that score, so far as their own business was concerned, their main reliance being on three points: First, the individuality of their own work; second, the number of Corliss engine builders whose work is good, and third, the intelligence of the mechanics, who so largely act as the advisers of steam users. As to this latter point, the speaker here quoted, evidently agreed with the view lately expressed by a successful builder of steam machinery, who said that, in introducing his machinery, he liked to get "as close to the fire-room" as possible.

A natural result of the state of things existing in the engine trade, is the stimulus thereby afforded to the inventive skill found in concerns long engaged in the construction and sale of first-class automatic engines, leading them to devise and adopt improvements in the mechanism of their product. Such improvements, whenever patentable, of course afford an important measure of protection, both as to design and price. Such improvements are also naturally to be expected from establishments whose designers have given years of close study to the subject of steam-engine economy.

A noteworthy illustration, as we are informed, is found in the statement that four prominent establishments building Corliss engines, and located in different parts of the country, recently had in the Patent Office, practically at the same time, improvements upon a portion of the Corliss valve gear, all intended to serve the same purpose, and all accomplishing it in different ways. That purpose was lessening the shock to the governor caused by disengagement, while also securing closer regulation. Establishments identified with other types of the automatic cut-off engine, will not be less likely to feel and profit by such a wide-spread impulse toward improvement, wherever their experience shows improvement to be possible.

For cutting tin, or thin sheet iron, with a cold chisel, grind the corners of the chisel to prevent them from cutting through the metal as far as the middle of the chisel does. By thus rounding the chisel smooth work can be done, which is impossible with a chisel with full sharp corners.

The Year's Allotment Already Sold.

It is authoritatively stated that American manufacturers of steel rails have already booked orders for the current year amounting to 723,000 tons. The product for 1886 was limited at the Saratoga meeting to 775,000 tons, but subsequently the amount was raised to 1,000,000 tons. At the recent meeting in Philadelphia it was agreed that when the orders received amounted to 800,000 the limit should be extended to 1,150,000 tons.

They Will Get Used to It.

The cable reports members of the British aristocracy aghast with astonishment and apprehension, because a workingman's representative, himself a workingman, has been appointed to an inferior place in the new Cabinet Ministry. Their present agony, over the first recorded occurrence of this kind, should not be allowed to last too long. The recent extension of the right of suffrage, now nearly universal, in Britain, will doubtless lead, in time, to other and greater surprises of the same sort.

When a workingman has risen to be prime minister, and the major part of his cabinet is made up, as in this country, of men who began at the foot of the industrial ladder, it will be time for real alarm. Because, by that time a good many members of the aristocracy, being no longer held by hereditary privilege, higher than their desert, will be likely to have settled, by their own weakness and inertness, to a level somewhere near the foot of that same ladder!

Technical Schools.

It is doubtful if, with equal expenditure of means, the same amount of effective work can be done for the future manufacturing interests of the country in any other way as can be by the establishing of schools, for which the one established in New York City, by Peter Cooper, may be taken for a model. Not that they should necessarily be of the same magnitude as this; but their aims should be in the same direction. Schools of this kind ought to be so common that every young mechanic could avail himself of their assistance in securing an education, so far as book knowledge goes, in matters relating to the trade he is learning or following. To be sure, all would not do so; but providing means would develop a large amount of latent talent that is now wasted. And the number of those who would be led, from example, to use convenient educational facilities would increase surprisingly, the result being that manufacturers would reap the benefits of having in their employ a class of workmen bringing to their work intelligence, and a training that fitted them to think of what they were doing. And the more of the thinking, reasoning habit that is centered in any manufacturing business, the better the prospects of success.

Considering the fact, now well understood, that in the future, manufacturing will partake more and more, from year to year, of the character of close competition as between different countries, the wisdom of providing every means for increasing knowledge of the subjects connected with it, ought to be apparent. In European countries this is very clearly understood, and the matter discussed and helped along in every possible way. Here but little attention is paid to it outside of three or four large cities, and thousands of young men, who are anxious to devote their leisure to study in the line of their work, find no help in doing so.

Those who have given the subject much attention have almost universally concluded that what is needed is co-ordinate education of the hand and brain. The late Professor Thompson, in his review of the reports of the British commissioners of technical instruction, a review recently made public, shows that in Europe the demand is so largely for men whose training has been, to a great extent, practical, to fill important positions; that there is an excess of men who have a training purely theoretical. He instances Germany, in which it was found that there were a large number of highly trained polytechnic graduates for whose services there was no demand, while the Austrian Minister of Instruction lamented the inability to reduce the number of theoretical engineers, and to replace them with those who had knowledge of both theory and practice.

If such schools as the Cooper Institute were as common as they should be, this uniting of theory and practice would be the result. We have in this country some excellent technical schools, and some of them appear to be fairly successful in uniting theoretical and practical instruction. But no more than the merest fraction of those who ought to have theoretical training are able to take advantage of their facilities. What is wanted is an opportunity for all, so that the best that is in every young mechanic may have an opportunity to develop itself. This is what technical education is coming to in Europe, and is what it must come to here. When this is so, the most important mechanical matters in manufacturing will be in the hands of those best able to manage them in all respects, because everyone who has sufficient energy to fill a position of trust, will have secured the necessary theoretical education.

Will "Sutherland," who contributed an article on "A Steam Heating Device for Shops," in our issue of May 21, 1881, favor us with his present address?

A correspondent would like information as to the best plan for making a floor for a blacksmith shop.

Literary Notes.

"MECHANICAL INTEGRATORS, INCLUDING THE VARIOUS FORMS OF PLANIMETERS." By Prof. Henry S. H. Shaw, New York: D. Van Nostrand, publisher, 23 Murray street, and 27 Warren stree.,

This is a very interesting little work, treating concisely the subject named in the title. The author seems to have succeeded in making reasonably clear the principles upon which integrators act. It would be difficult to get more information on the subject into the same space. The price of the book is only 50 cents.

Architectural, Part III., edited by F. A. Wright and published by Wm. T. Comstock, 6 Astor place, New York, contains thirteen designs for stables. The price is $1.

Our lively hardware and stove contemporary, the *Ironmonger*, has removed its office of publication from Chicago, to 102 Chambers street, New York. The paper appears to be prospering.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(79) W. V., Bushnell, Ill., asks: If a boiler will stand 100 pounds cold water pressure, what steam pressure will it be safe with? *A.*—Cold water pressure is not applied to a boiler to determine its safety under steam pressure. This must be judged from other considerations. A cold water test of 100 pounds would generally be used for a boiler to carry 70 pounds steam pressure.

(80) Subscriber, ——, asks: 1. In the construction of a vertical boiler, the dimensions of which, as I have them, would be about 36 inches diameter and 6 feet high; furnace, 27 inches diameter, 31 inches high; boiler constructed of steel; holes drilled; boiler to carry high-pressure; would it be practicable to use tubes as small as 1 inch diameter, so as to crowd all the heating surface into a small space? *A.*—It would be practicable to use 1-inch tubes, but we think you would get better results with those 2 inches diameter. You will get all the heating surface that will be of any advantage with 2-inch tubes. 2. Of what metal should the tubes be, and what should be their thickness. *A.*—For anything in the way of ordinary pressure, use iron or steel tubes of ordinary thickness, as furnished by the manufacturers of boiler tubes. 3. Would it be practicable to fasten engine to boiler, or would it induce injurious strains? *A.*—This is very commonly done; but it of course induces extra strain. If done with good judgment, it will be satisfactory. 4. Would such a boiler work up to twelve horse-power? *A.*—It might, by considerable crowding. About eight horse-power would be nearer its capacity.

(81) **A. H. A., Chicago, Ill., asks:** Does it cost more to heat by exhaust steam than by live steam? *A.*—Frequently it does, but not necessarily. Exhaust steam heating can be put up so as not to increase the back pressure on the engine, then all the heat got from it may be clear gain.

(82) **E. D. R., Maquoketa, Iowa, asks:** Why do trap springs break under water when near the freezing point, when the same springs will withstand varying changes in the atmosphere without breaking? *A.*—We do not believe that the fact of their being in water has anything to do with their breaking.

(83) **R. M., Warren, Pa., writes:** Please give me your opinion about grinding slide-valves to their seats after scraping. It is practiced in some shops, but I think myself that the emery works into the iron and hastens the wear. *A.*—The opinion is substantially universal that slide-valves should not be ground to their seats for the reason named by you.

(84) **R. J., Waterloo, N. Y., asks** how to melt rubber so as to take impressions on type for making rubber stamps. *A.*—The impression of the type is taken in calcined plaster, or "plaster-of-Paris," as it is often termed. The rubber is then made soft by heat, forced into the mould and cooled under pressure. It is not melted completely, so as to be poured like iron or brass. Most makers of rubber stamps regard the details of their methods as very choice "trade secrets," and keep them accordingly close.

(85) **A., ——, Creston, Iowa, writes:** I do not understand the duties and object of the port valves; that is, the valves in the ports, between main valve-seat and bore of cylinder, as may be noticed on large, direct-acting pumps? *A.*—We presume you refer to valves sometimes used for regulating compression.

(86) **Engineer, ——, writes:** 1. You have told how to set a slide-valve, but never how to set a rotary valve. I find that such a valve, connected from eccentric to valve-stem arm, will not cut-off at the same point on each end. I have tried shifting the arm on valve-stem, but cannot equalize it. Can it be done? *A.*—The rotary valve is set precisely as a slide-valve would be. It is also just like a slide valve in that, if set with equal lead at both ends it will not cut-off alike at the two ends. The only way to make such a valve cut-off square is to give more lead on one end than the other; in other words, you can set it so that it will cut-off square, but will then find that the lead will be unequal. 2. Which is the best for steam, a gate valve or a globe valve? *A.*—For some purposes, one may be the best; for other purposes, the other.

(87) **J. M. B., St. Paul, Minn., writes:** 1. Our engine is located about 75 ft. from workshop. Which would be the most economical way of conveying power, by geared shafting, or wire or leather belt? *A.*—Sufficient data is not given regarding power to be transmitted, and of the velocity at which the belt can be run. For a small amount of power and a low velocity, a leather belt would probably be preferable. If a large amount of power is to be transmitted, and the belt can be run at a high-speed velocity, say from 5,000 to 8,000 feet per minute, wire rope may be preferable. 2. Which would give the least trouble? *A.*—The chances would be in favor of the wire belt. 3. What would be the loss of power by conveying it with geared shafting? *A.*—The loss would probably be about six or eight per cent., but we have seen cases where, by neglect, nearly fifty per cent. of the power was used up by crooked shafting and bad gearing.

(88) **H. R. W., Birmingham, Ala., writes:** 1. Are there any books published upon the construction of steam pumps, or how to proportion or design them? For example: I want an 8" plunger, 14" stroke; what size steam cylinder would it require at 80 lbs. steam pressure, and what size suction and discharge pipes would be required? What should be the area of the suction and discharge valves? Is it better to have small valves, and more of them, or would you prefer a less number of large valves? *A.*—We are not aware that any book on the above subject is in print. Much of the desired information could be derived from works on hydraulics, natural philosophy, and other works of like description. It would not pay to attempt building a steam pump. There are several manufacturers of steam pumps who have made a special study of the above questions, and can supply at once a pump suitable for any combination of circumstances which may arise in engineering practice. At the same time they can guarantee a given result at a cost much less than a single pump could be built, to say nothing of the many experiments needed to determine the most economical proportion of the several parts. 2. Will a piston pump throw more water than a plunger pump, and why? *A.*—A piston pump is double-acting, and throws two cylindersful of water as often as a plunger, as the term is generally understood, throws the cylinder once full. Plunger-pumps, so-called, are sometimes double-acting, then their capacity is equal to that of the piston pump.

(89) **A. M. C., Martinsville, Ga., writes:** 1. In reply to V. S., Question 314, AMERICAN MACHINIST of Nov. 7, 1885, in reducing tenths to eighths, you say multiply by 8. Thus: $.5 \times 8 = 4$; .4375 is equal to $.4375 \times 8 = 3\frac{1}{2}$ eighths. I do not understand the operation. Will you explain how .4375 is obtained in multiplying .5 of an inch by 8? I find, in comparing a standard rule with a decimal, that .5 of an inch is considerably more than 7.116. *A.*—You have got two examples mixed. First, .5" equals ½ or 4-8ths inch; that is, $.5 \times 8 = 4$, which is the number of eighths. By the same rule, .4375, which is four-tenths and a fraction of a tenth, equals $.4375 \times 8 = 3.5$, which is thenumber of eighths; 3½ eighths is equal to seven sixteenths. 2. I am in charge of four boilers, in two sets. One set of which are 60" diameter, 32 ft. long, with two flues 20" diameter, and one return flue. The distance from grate is 40"; length of grate, 6 ft.; bridge wall is 10' from shell, and at back end is another wall 6" from shell. The chimney is 60 feet high and 4 feet square. The others are ordinary double-flue boilers (no return flue), 32 feet long; these supply much more steam than the others. What is the advantage, if any, of the return flue, and is it not a source of danger? *A.*—We do not think there is any advantage in the case cited. The only way to determine what the trouble with your boilers is, is to find the temperature of the escaping gases in the flues. You will very likely find that the return flue is a damage to you. If we were to use the back bridge wall at all, we should make it not less than 10" from shell. The return-flue is not considered dangerous. 3. Is there a rule for computing the proportion of sunk keys for wheels and shafts? *A.*—There are various rules. You will find one in the AMERICAN MACHINIST of May 28, 1881. 4. What would be the effect of lime on slide-valves and piston of an engine? *A.*—It would tend to cut them.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Power measured.–F. Van Winkle, 22 Cortlandt, N. Y.

Alt, Mechanical Engraver on Wood, 318 B'way., NY

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Steel Shank, Wire Nail, Shoe Nail and Tack Machinery. Keith & Trufant, Campello, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Pattern Letters and Figures to be put on patterns of castings. H. W. Knight, Seneca Falls, N. Y.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

Patent Attorney and Expert. Machine designs and details. Wm. H. Weightman, 82 Astor House, NY

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Lyman's Gear Chart. How to Lay Out Gear Teeth. Price, 50c. E. Lyman, C. E., New Haven, Conn.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Feb. 13, p. 12. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

13 engines, all sizes in store, cheap; machinery, tools and supplies; lists sent on application. Jackson & Tyler, Baltimore, Md.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

The Magic Square—A novel instrument for solving problems in arithmetic by a mechanical method without mental labor; equal to a slide-rule, twenty ft. long. By mail, 25c. W. H. Wythe, Ocean Grove, N. J.

The Chandler Water Motor.—Five years successful trial has proved the Chandler Motor to be the most reliable and economical motor made. Built in six sizes, from ½ to 12 horse-power. Efficiency, safety and economy combined. Send for illustrated catalogue and price-list. Factory and warerooms, 132 Oliver street, Boston, Mass.

"Locomotive Engine Running and Management." By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air-brake explained by aid of engravings. Price, $2. For sale by "National Car Builder," 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES

The Osgood Dredge Co., Albany, N. Y., report inquiries and orders good for their dredges and excavators.

The Naugatuck (Ct.) Cutlery Company, which has been suspended for a year, has resumed manufacturing.

The Webster and Comstock Mfg. Co., Chicago, Ill., contemplate building extensive additions to their works.

According to the *Brenham Weekly Banner*, there is a movement on foot to establish a paper-mill at San Marcos, Texas.

The tire mill of the Standard Steel Works, at Logan, Pa., which was recently partially burned, will be at once rebuilt.

A new machine shop is to be built at Pottstown, Pa., by John R. Saylor, of Philadelphia, and S. H. Ralston, of Norristown, Pa.

The Thurston Mfg. Co., Providence, R. I., has been formed to succeed the machinist firm of Thurston, Stearns & Co.

Greenleaf & Baker, of Atchison, Kansas, will soon begin the construction of an elevator at Republic City, Kansas.

A wood-turning establishment, on quite a large scale, is being fitted up to start the coming spring at Livermore Falls, Maine, by F. S. Richmond.

The *Millstone* says that as soon as the new dam is completed at St. Cloud, Minn., a flour-mill, a saw-mill, and a paper-mill will be erected at that place.

A. & P. Roberts & Co., 261 S. Fourth st., Philadelphia, Pa., have purchased the Huntingdon Car Works, and will remove them from Huntington to Mount Union, Pa.

The Lancaster watch factory, at Lancaster, Pa., has recently started up after a suspension of a year. It is expected that in a short time the factory will employ 200 hands.

The Michigan Iron Works, Grand Rapids, Mich., have been purchased by Wm. T. and Wm. H. Powers, who will at once begin work in the machine shops and foundry.

Peabody, Kansas, has voted $15,000 to build water works. Meriden, Miss., is to have water-works, and Anderson, Ind., Waterloo, Iowa., and Philipsburg, N. Y., have been struck with the water-works epidemic.

William Lane, 58 St. Mark's Avenue, Brooklyn, N. Y., will build a five-story brick factory on the Northeast corner of Fifth Avenue and Sterling place. Cost, $23,000. W. M. Coots, architect, 26 Court street.

The Lake City Tool Co., have accepted favorable propositions made them by the citizens of Brooklyn, Wis., and removed their works from Beloit to that place, changing their title to the Duplex Wind Mill Co.

The plant of the Cleveland Crucible Steel Works, Cleveland, Ohio, has been leased by parties from Cuyahoga Falls, Ohio., who will make alterations, and start the works under the style of the Cuyahoga Rolling Mill Company.

In addition to the various specialties manufactured by them, the Cohoes Iron Foundry and Machine Co., of Cohoes, N. Y., have arranged to make the building of experimental and special machinery a distinct department in their business.

According to the New York *Sun*, all the cotton mills in New Bedford, Mass., the China, Webster and Pembroke Mills, at Suncook, all the mills in Manchester, N. H., and L. W. Faulkner & Sons, of Lowell, have advanced wages ten per cent. The advance will take effect on March 1.

Charles Ward, Charleston, W. Va., has been obliged to increase his facilities for building his steam generator, and for general boiler and machine repairing. He has taken the works formerly known as the Kanawha Pump Works, and is putting in lathes and other tools suited to his work.

The Fishkill Landing Machine Co., Fishkill-on-Hudson, N. Y., report inquiries for their Corliss engines as being numerous, and nearly all meaning business. Orders come in freely, January being their best month for years past. Prospects good; the only ground for complaint being as to prices.

The Warder, Bushnell & Glasner Champion reaper and mower shops, Springfield, Ohio, have put in, to take the place of grindstones, eight tool-grinders, and the Ohio State University, of Columbus, has put in one, manufactured by the Springfield Glue and Emery-Wheel Co., of Springfield, Mass.

The Albany Steam Trap Co., of Albany, N. Y., report 1885 as a good year in their steam trap business, with business and prospects good for the present year. The Blessing renewable-seat stop and check valves, illustrated in the AMERICAN MACHINIST, September 13, 1884, have met with great favor, and are being widely introduced.

The Sherwood Mfg. Co., Grand Rapids, Mich., has been incorporated with a capital stock of $25,000, for the purpose of manufacturing carriage-bow sockets. The officers are: President, J. F. Ferris; Vice-President, Joseph W. Sherwood; Secretary and Treasurer, Chas. R. Bacon. The factory is located at the corner of Prescott and South Division streets.

The Electric Manufacturing Co., 24 Fifth street, Troy, N. Y., says *New Enterprises*, will erect a new factory at Greenbush, N. Y., early in the spring. The building will be of brick and stone, two stories high, and either steam or water-power will be used. Wm. H. Scranton, formerly superintendent of the Oxford Iron Co., Oxford N. J., and a party of capitalists have decided to build a steel nail factory at Buttzville, and C. R. Thompkins, of Rochester, N. Y., will erect a machine-shop. The structure will be of brick, two stories high, with engine-house attached.

The *Star*, Charleston, W. Va., says: "A proposition will shortly be made by a company of practical nailers, of Ashland, Ky., who have a cash capital of $50,000 to invest in putting up a nail factory at the capital, provided they receive any inducement. The terms of the proposition are that, if the citizens of Charleston, individually or collectively, will raise $30,000, payable when the nail works will have been completed, the works will be located there, and this amount will be refunded to the investors by the company, which proposes to pay the amount by holding back 25 per cent. of all wages earned by workmen, each of whom will be a stockholder, and who holds his stock in the $50,000.

Chicago loses, says *Iron*, and Pittsburgh gains an important industry. The Crane Bros. Mfg. Co., of the former city, has decided to remove its wrought-iron pipe mill to the latter city, where a company has been formed, comprising members of the Crane Bros. Mfg. Co., of Chicago, and members of Moorhead & Co., and the Keystone Rolling Mill Co., of Pittsburgh. The new plant will be located on grounds adjoining Moorhead & Co.s'. An iron structure, 250x250, will at once be erected, and, when completed, 350 to 500 men will be employed. Mr. Crane, President of the Crane Bros. Mfg. Co., alleges as his reasons for removal the fact that the cost of manufacture will be greatly reduced by the employment of natural gas and by the superior shipping facilities afforded the new plant.

The Beebe & Holbrook Company, Holyoke, Mass., have recently purchased of the Messrs. Newton their Connecticut River Pulp Company property, on the second level canal, for about $45,000. Plans are now being made by the purchasers of this property, which adjoins their present mill building, for the erection of new buildings and the making of important changes in their old ones, which will increase their output of paper to eight tons a day, their daily product at present being four tons. It is the intention of the Beebe & Holbrook Company to put in the best machinery and equipments of to-day, and to make their new mill, when completed, the model paper mill of the times. The projected improvements will occupy a year or more of time in their completion.—*The Paper World.*

The Co-operative Manufacturing Company, Homer, N. Y., have plans for a factory building, 102 feet long by 40 feet wide, prepared by O. A. Bovee. No contract for the erection of the building has yet been let. McNeely & Johnson, of Salisbury, N. C., will rebuild their factory, which was recently destroyed by fire. Cost, $12,000. A. H. McNeal's iron foundry, at Burlington, N. J., is to be purchased by a syndicate composed of New York capitalists, who will organize a stock company, in which A. H. McNeal will be largely interested. The works will be enlarged. The iron foundries at Millville, N. J., belonging to R. D. Wood & Co., office 400 Chestnut street, Philadelphia, Pa., will in a short time cease operations, for the purpose of making extensive repairs and improvements. The works will be idle about two months.—*New Enterprises.*

The Merino Shoe Company, Kennebunk, Me., who are busily engaged in fitting up a shop with machinery, as recently announced in these columns, will soon be employing 150 hands, and turning out 1,800 pairs of wool boots daily. The Paris Manufacturing Company, South Paris, Me., are erecting a building for a wood-turning shop, this branch of their work having heretofore been carried on elsewhere. The Bangor Edge Tool Company, Bangor, Me., contemplate the coming spring putting in an 80-horse-power engine, with boilers and other machinery, to accommodate their increasing business. The Glen Manufacturing Co., Berlin Falls, Me., are now putting up their pulp mill, which completes their plant, so far as the large buildings are concerned. Thus far they have used up 18,000 casks of cement and 300 cars of brick. The company contemplate building a large number of cottages across the river from their mills.—*Industrial Journal.*

The Eclipse Wind Engine Co., Beloit, Wis., report the amount of business done in 1885 equal to that of the year previous. The sales for December, 1885, and January, 1886, are better than they have ever had for the same two months. A number of special tools have been added to their machine and wood-working shops, and all departments have run steady throughout the year. The foundry, which turned out 2,000,000 pounds of castings during 1885, has just received an order for 2,000 pump cylinders, embracing 28 sizes, in addition to their regular work of wind-mills, double-acting pumps and Hill clutch-pulleys. The old year closed and the new year opened with car-load shipments to the following places: County Line, Wis.; Kenosha, Wis.; Winchester, Mass.; Big Springs, Texas; San Antonio, Texas; Las Vegas, New Mexico; Lincoln, Neb., Albuquerque, New Mexico; two carloads, Moscow, Russia. The mills to Moscow are to be marked in Russian letters. Orders for the Hill clutch-pulleys are exceptionally good.

Machinists' Supplies and Iron.

NEW YORK, Feb. 11, 1886.

The market has ruled quiet during the past week, with a hopeful feeling for the future.

Iron—In American pig the market has developed no new feature. The demand is only that of consumers. We quote Standard Lehigh and North River brands $18 to $18.50 for No. 1 X Foundry; $17 to $17.50 for No. 2, and $16 to $17 for Grey Forge.

Scotch Pig—The market continues dull. The demand has been moderate with Coltness at $20.50 to $21; Glengarnock, $20.50 to $21, to arrive; Gartsherrie, $20 to $20.50; Summerlee, $21; Eglinton, $18.25; Langloan, $20, and Dalmellington, $19.50 to $19.75.

Tin—Prices are higher, owing to a tendency to speculate. Banca, 22½c.; Straits and Malacca, 20.80c. cash, or 20.90c. at 20 days.

Spelter—Moderate demand; refined, 5¼c.

Antimony—Hallett's, 8¾c.; Cookson's 9¼c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Experienced tool draftsman seeks a position. Address O. K., AM. MACHINIST.

First-class foundry foreman wants position; best reference. Address Cupola, AM. MACHINIST.

Wanted—A foreman to take charge of a hardware and small tool factory employing about 20 men; state age, and wages wanted. Address Box 1, AM. MACHINIST.

Wanted—A draftsman to assist in planning and carrying out additions to buildings and machinery, in a manufacturing establishment. Address "R.," P. O. Box 2, Wilmington, Del.

Wanted—Situation as foundry foreman, by a man of long experience on machinery and steam-engine work; knows how to handle men, and understands mixing metal. Address Mixer, AM. MACHINIST.

Wanted—A man with good mechanical knowledge and experience, familiar with printing machinery and competent to take charge of work and men. Address "Jamieson," AM. MACHINIST.

Mechanical engineer and draftsman, experienced in shop and office, with experience as designer of machine tools, lifting machinery, turbines, engines, etc., desires situation. Address T. S., AM. MACHINIST.

Wanted—Position as foreman or superintendent of mach. shop; large experience in machine and tool building, and management of help; first-class references to those who mean business. Address Box 367, Waterbury, Conn.

Wanted—Situation as foreman of machine room. Experienced in the management of machinists, die-makers, etc., drafting, tools, fixtures and special machinery, making and running engines, and millwrighting. Address "Systemizer," AM. MACHINIST.

A Mechanical Engineer, of large experience in designing and building machinery and handling men, and of complete practical and technical education, desires a situation in some large mechanical establishment. Address Mechanical Engineer, care of Lord & Thomas, Chicago, Ill.

Energetic mechanical engineer and constructor, theoretical and practical, wishes position as superintendent or chief draftsman; 15 years' experience as constructor, engineer, manager and expert in Europe and in this country. French, English and German. Address S. Kunzman, 32 Maiden Lane, N.Y.

A competent man, who is now superintendent of of an establishment employing over 200 men on light work, wishes to change his position; is a good, practical draftsman and mathematician, and experienced in designing special machinery and tools. Address "Mechanic," Box 245, Hartford, Conn.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Crescent Steel Tube Scraper is king. Crescent Mfg. Co., Cleveland, Ohio.

Machine shop and foundry for sale in a Western city; full or half interest. S. & H., AM. MACHINIST.

Wanted—Foot or small power lathes or outfits, new or 2nd-hand. Address Box 967, Freeport, Ill.

Light mach'y of all kinds built at short notice. Pennington & Mills, 8 Dey st., Jersey City Heights, N. J.

Special mchs. for any kind of mfg. designed to order. Also plain and autom'c eng's. Send for circular and refs. Weston & Smith, Syracuse, N. Y.

To make room for larger tool, will sell cheap, for cash, a planer 42"x42"x12', in good order. Address P. O. Box 2085, Bridgeport, Conn.

C. F. Langston & Co., 222 N. 5th st., Phila., can-makers' tools, presses, dies and special machinery built, rotary cutters made and gronnd.

Gear Cutter—For sale, cheap, by Fitchburg Machine Works, manufacturers of machinists' tools, Fitchburg, Mass., one second-hand 36" (Putnam) gear cutter, in good condition.

For Sale—Shafting lathe, 28" swing, takes 20' between centers; treble-geared; 5 speeds on cone, for 2¾ belt; screw feed, but not screw cutting; also cylinder boring-bar 6" diameter, screw feed; cutter-head 9" diameter, 60' traverse. A. L. Henderer, Wilmington, Del.

Engine and Boiler—30 horse-power Buckeye engine; 42"x12' tubular boiler; all pipes and fixtures, including injector, heater and smoke-stack; the whole in good condition; in use about three years; to be replaced by larger engine, etc., of same make; can be seen in operation until Mch. 1. Address Geo. A. Barnard, 70 Astor House, New York.

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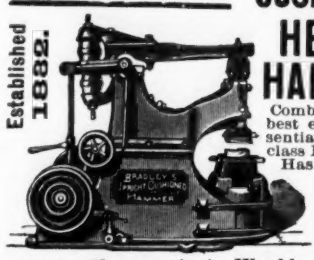
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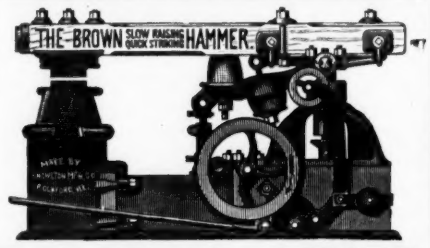

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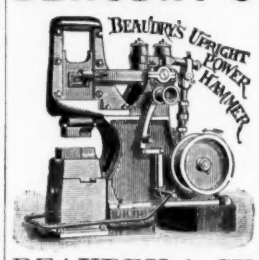

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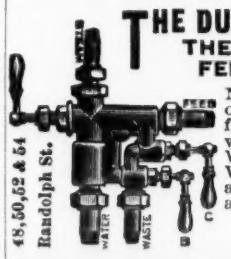

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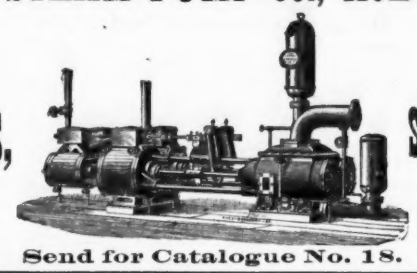
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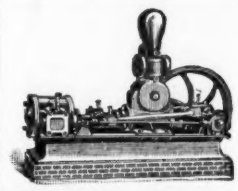
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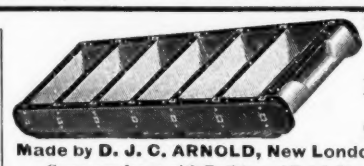
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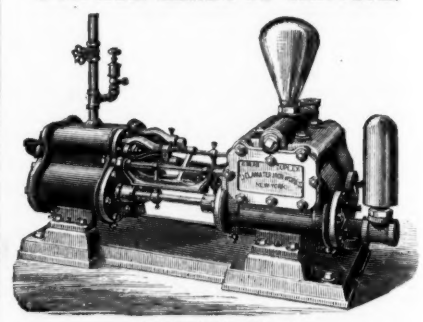
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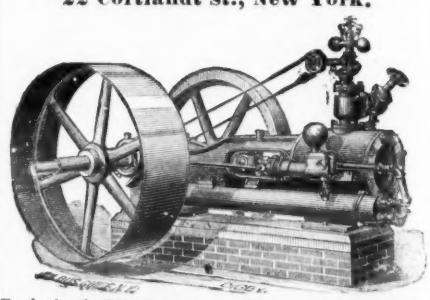
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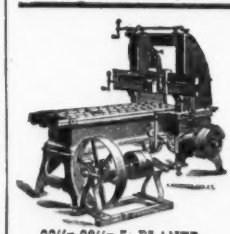
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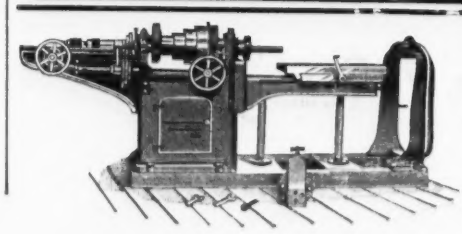
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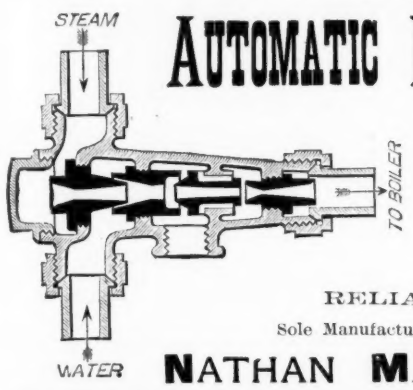

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Said patent and machine is an improvement in machines for the manufacture of horseshoes, whereby a bar of iron is fed to the machine, from the furnace. The bar is then creased, cut the desired length, formed into shoes and hammered before passing from the machine.

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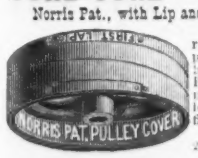

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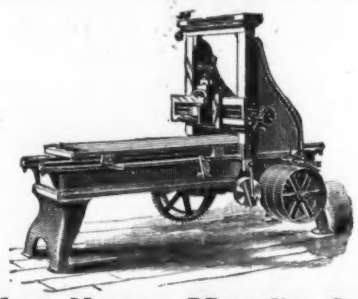

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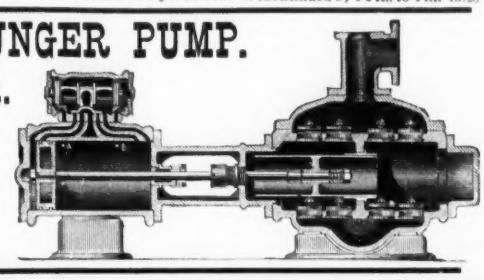

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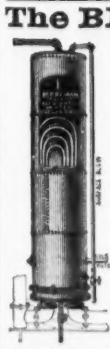

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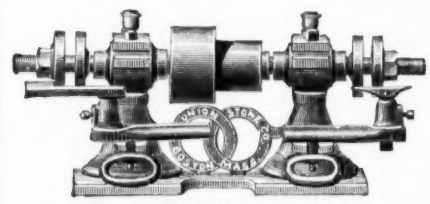

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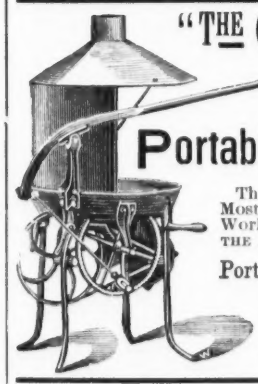

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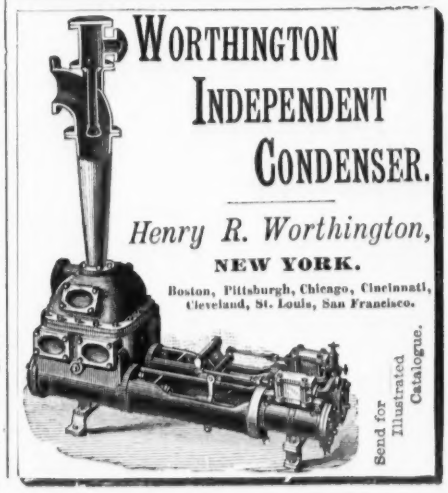

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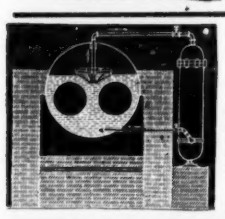

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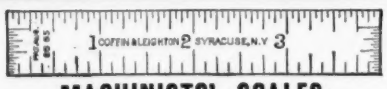

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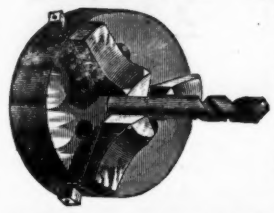

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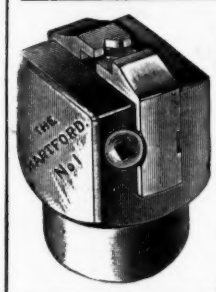

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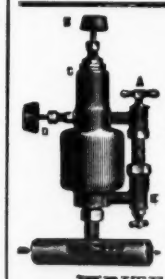

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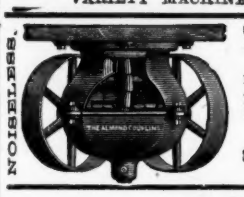

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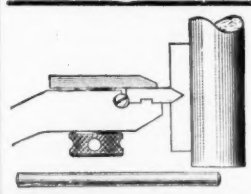

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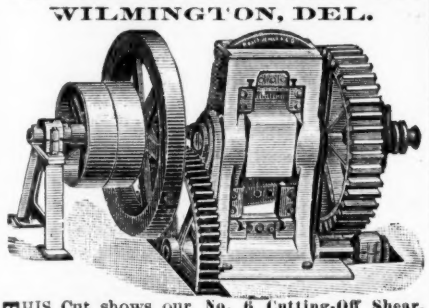

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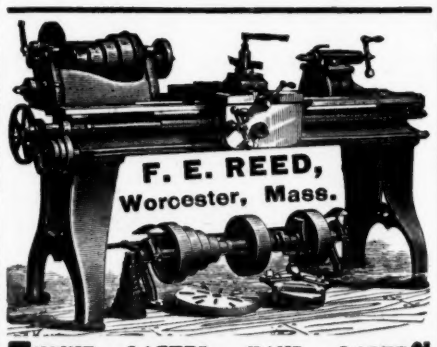

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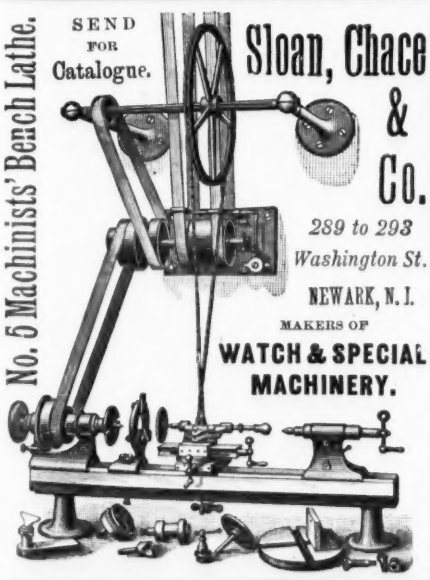

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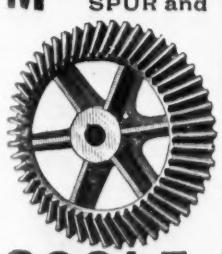

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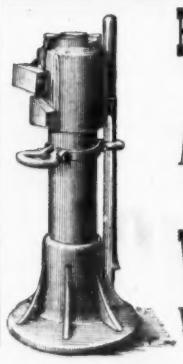

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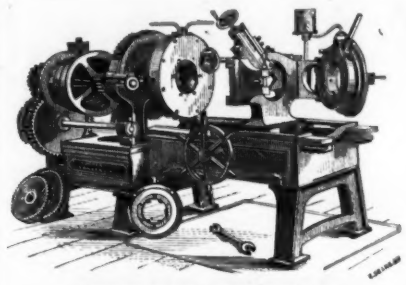

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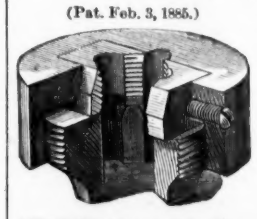

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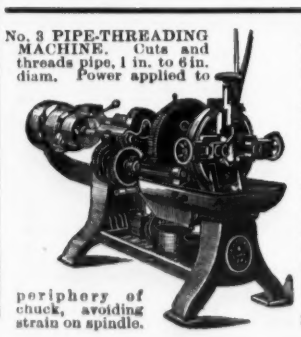

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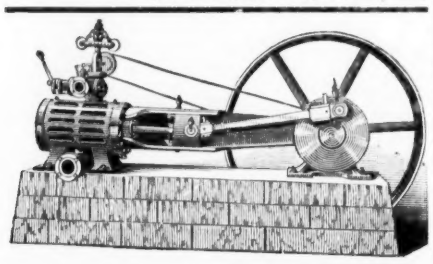

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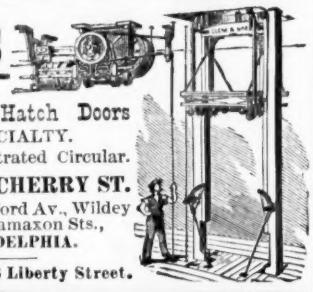

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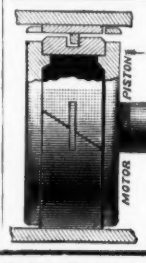

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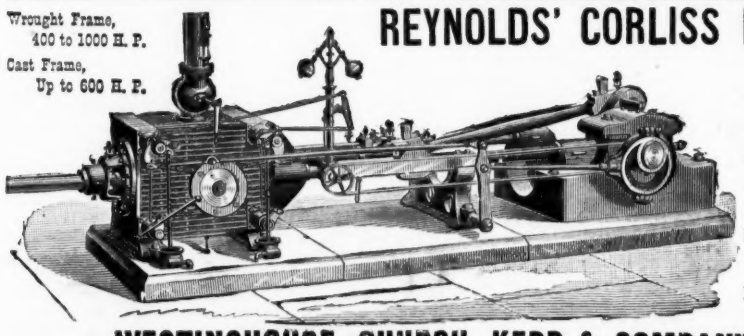

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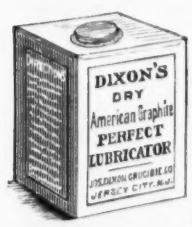

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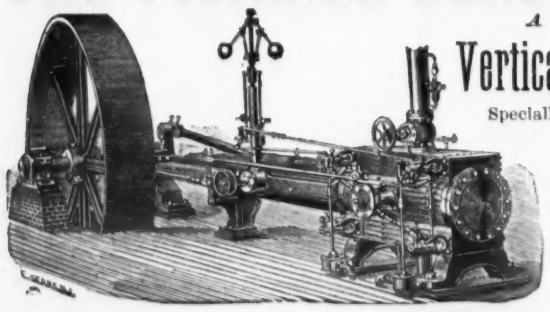

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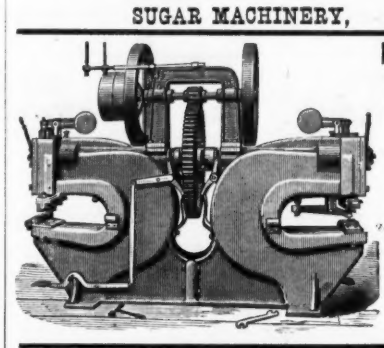

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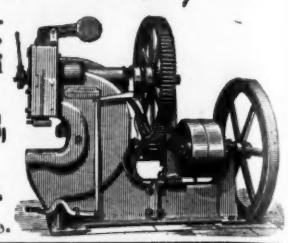

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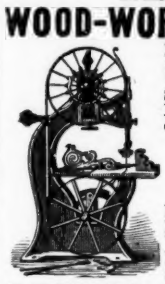

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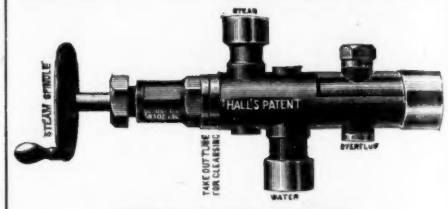

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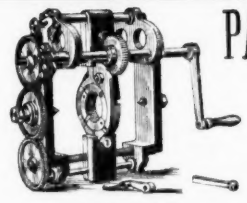

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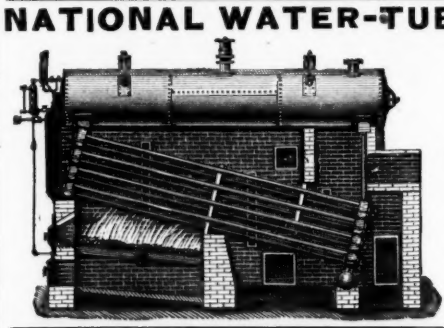

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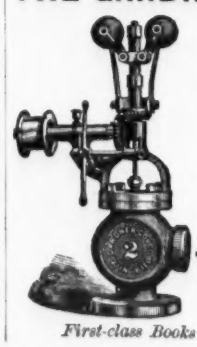

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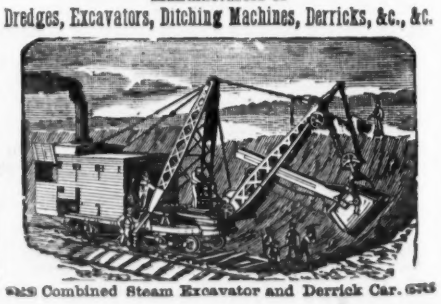

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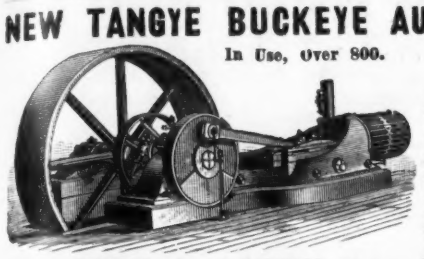

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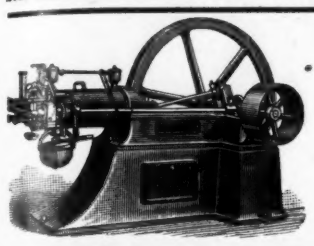

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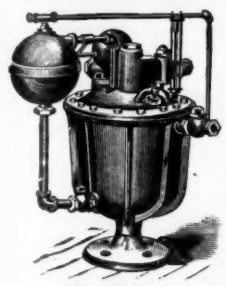

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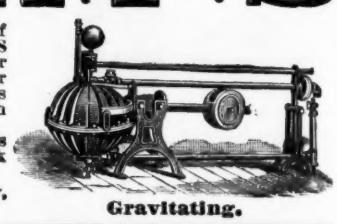

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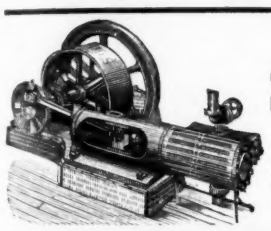

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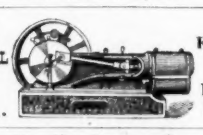

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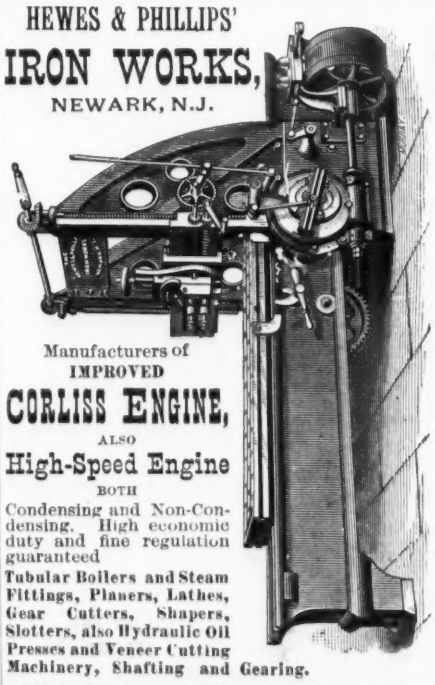

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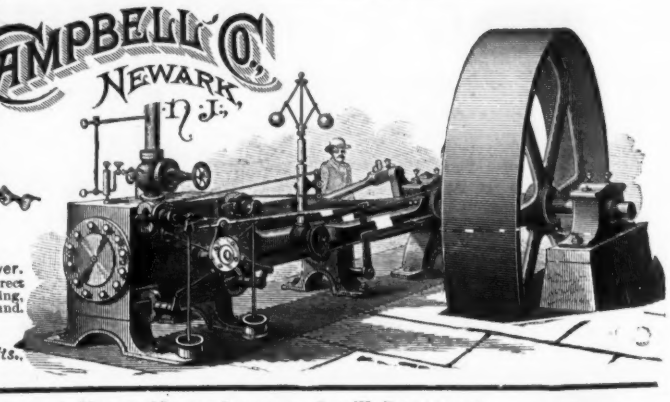

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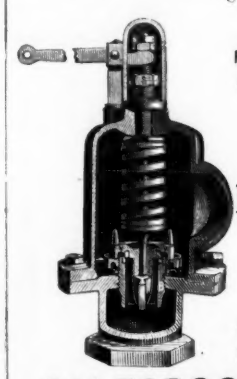

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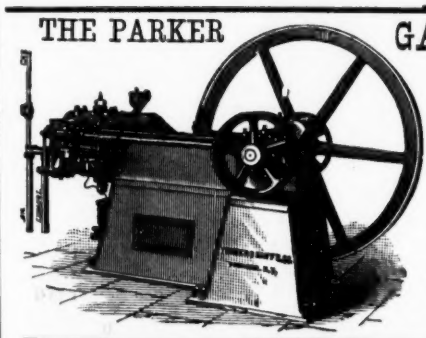

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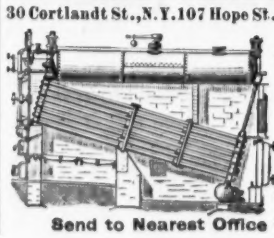

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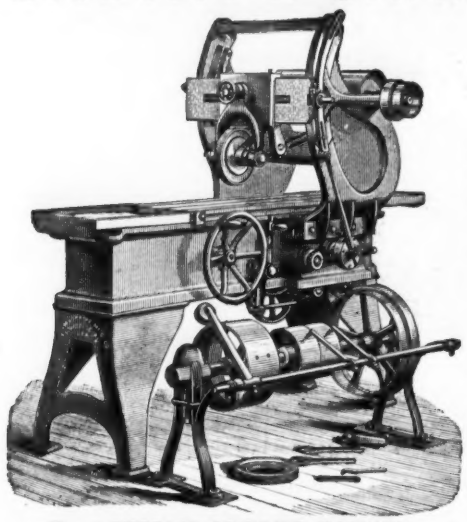

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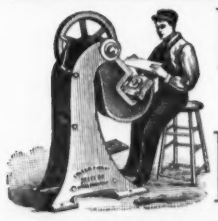

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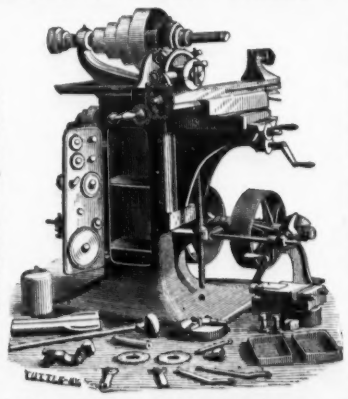

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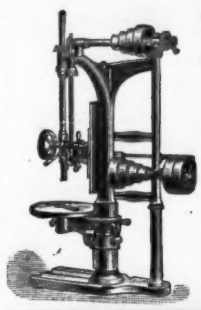

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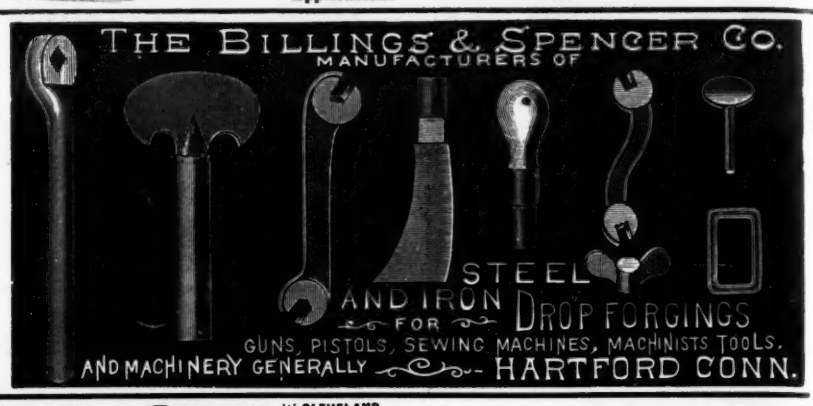

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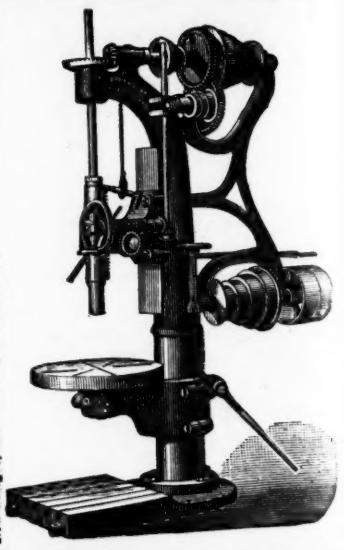

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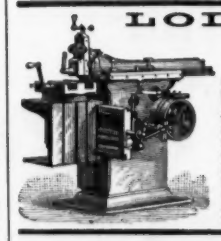

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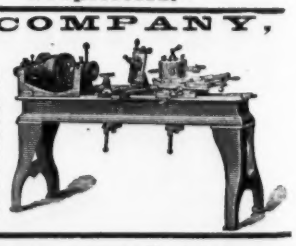

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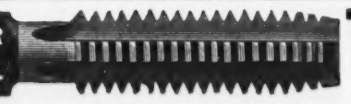

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